OLOGY DEPT.

POWER

OCTOBER, 1944

POWER GENERATION, TRANSMISSION, APPLICATION AND THE ATTENDANT SERVICES IN ALL INDUSTRY

PUBLIC LIBRARY
DETROIT

Remodeled power distribution system eliminates overloaded conductors, poor voltage regulation, low pf and inadequate lighting, to boost postwar production. Page 64

Pacific Northwest for new industries: It offers opportunity to use electric power in vast amounts from Bonneville, Grand Coulee and a score of projected new hydro developments of Columbia River and tributaries, p 88

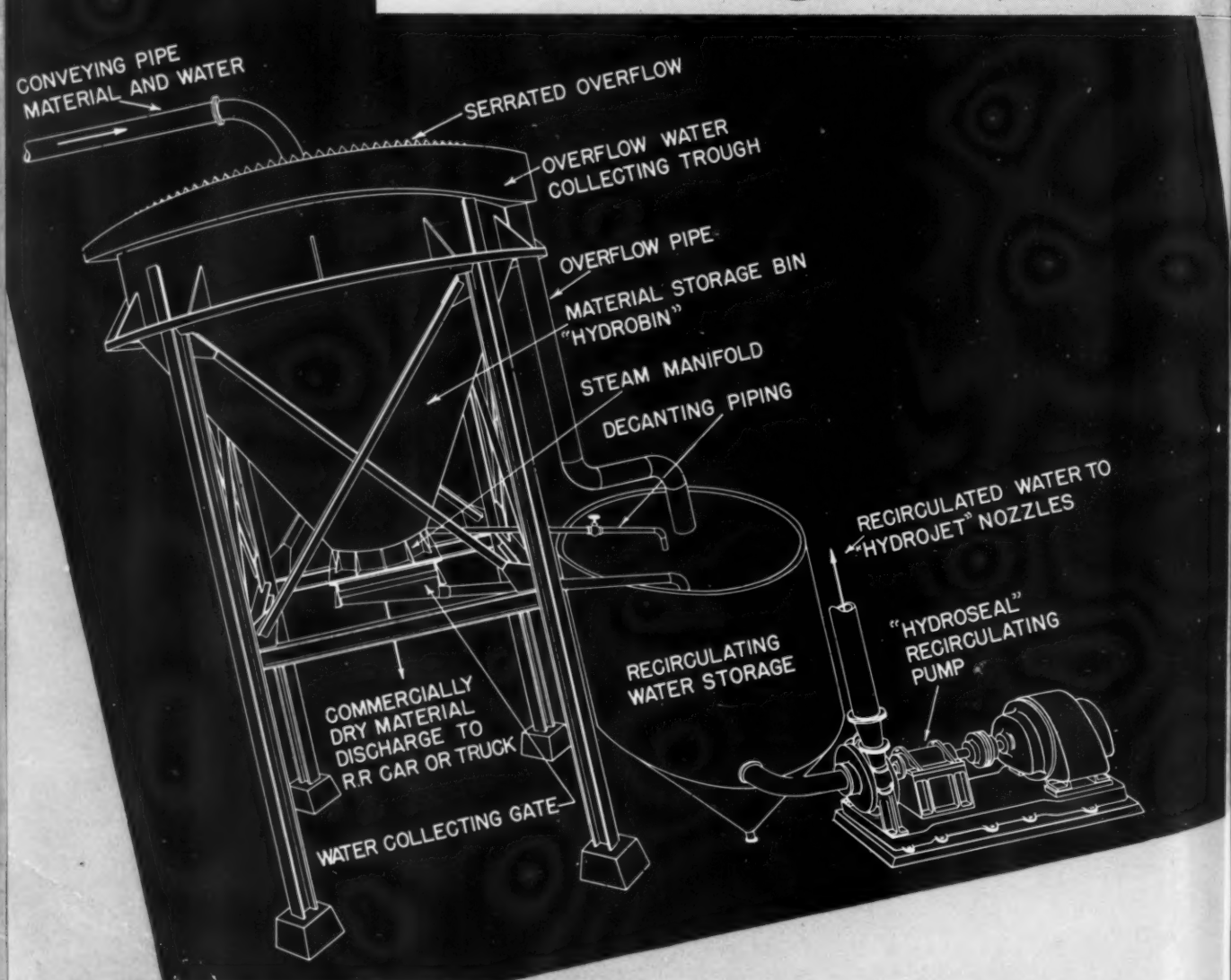
"How to" articles: keeping diesel crankshafts, connecting rods and bearings in trim, page 74; making power-plant cleaning jobs easy, page 82; timely maintenance for tip-top heating systems, page 103

TABLE OF CONTENTS
Page 59

Ashes Pumped WET—Delivered DRY

Ash and dust laden water enters the Hydro-Bin at the top; the water being re
moved by the overflow trough at the top, decanting elements at the sides and
water collecting gate at the bottom of the bin. Commercially dry refuse remains in th
bin, for unloading into cars or trucks. Water removed from the bin can pass int
a sewer or it may go to a storage tank, as illustrated, for recirculation throug
the Hydrojet System of Ash Removal or the Hydrovac System of Dust Remova
Hydroseal Pumps are used for pumping refuse into the bin and for recirculation o
water. . . . The Dewatering Hydro-Bin is equipped with a steam manifold aroun
the discharge gate, to insure operation in sub-freezing temperatures. Our neares
representative will gladly give you full information about this and other method
of refuse disposal available where Hydrojet and Hydrovac Systems are used

Dewatering HYDRO-BIN



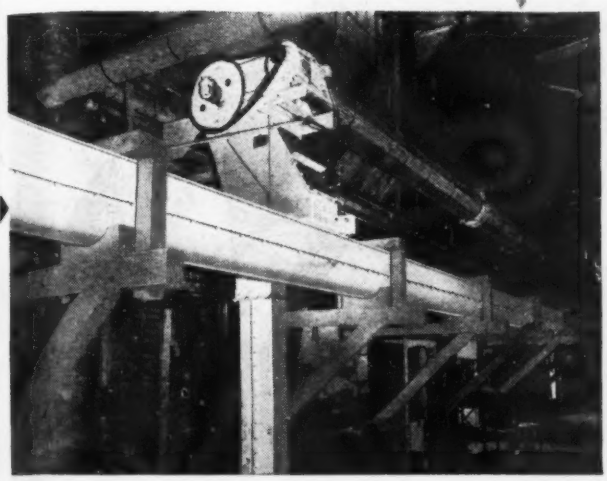
ALLEN-SHERMAN-HOFF CO., 227 S. 15th St., PHILADELPHIA 2, PA. Offices & Representatives in Principal Citie

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," and "The Stationary Engineer"), October, 1944, Vol. No. 10. Published monthly with an additional Directory number in December. McGraw-Hill Publishing Company, Inc., Publication office 99-129 North Broa way, Albany 1, N. Y. Editorial and Executive Offices, 330 West 42nd Street, New York 18, N. Y. Entered as second class matter, August 25, 1936, at Albany, N. under the act of March 3, 1879. Printed in U. S. A. Allow at least 10 days for change of address. All communications about subscriptions should be address to the Director of Circulation, Power, 330 West 42nd Street, New York 18, N. Y. Subscription rates—U. S. and U. S. Possessions, $3.00 for one year, $4.00 for t years. Canada, $3.50 for one year, $5.00 for two years. Great Britain and British Possessions, 36 shillings per year. All other countries, $6.00 for one ye $9.00 for two years. Single copies 35 cents.

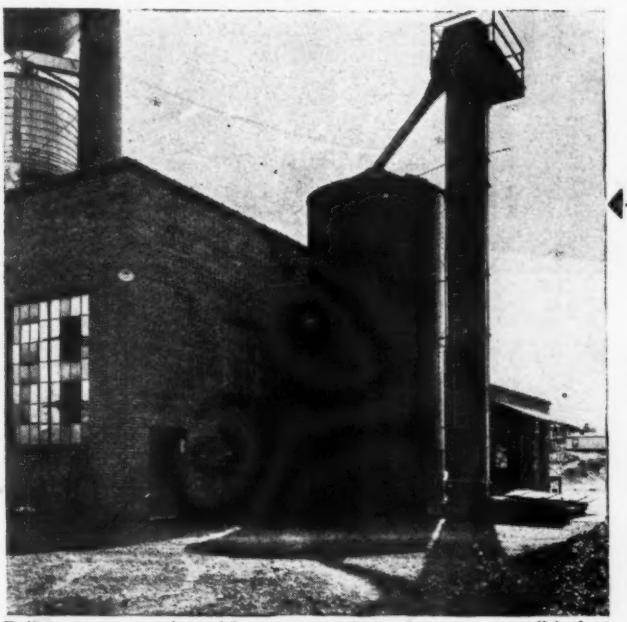
LINK BELT

COAL AND ASHES HANDLING EQUIPMENT

MODERNIZATION OF HANDLING METHODS SOLVED PROBLEMS FOR THESE SMALL AND MODERATE SIZE PLANTS

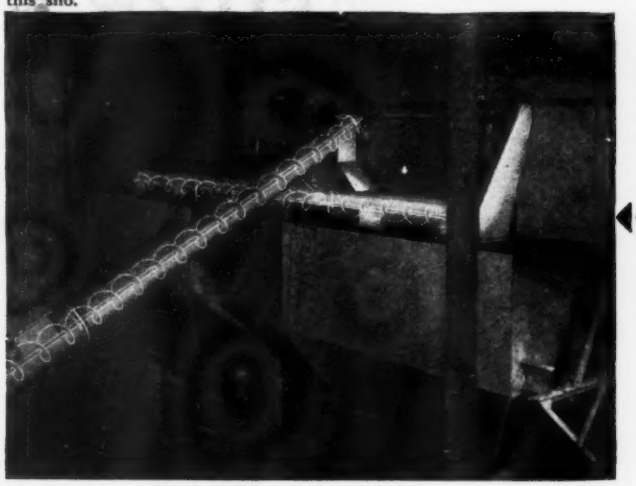


A combination Bulk-Flo elevator-feeder and horizontal screw conveyor which delivers coal from storage pile outside of boiler room, direct to boilers. This equipment replaced a time and labor-wasting practice of carting coal in wheelbarrows and firing by hand.



Boiler room expansion with covered coal storage was accomplished at this laundry without enlarging or raising roof of building or bunkers. Link-Belt elevator takes coal delivered by truck to silo with 20 ton live and 80 ton dead storage. Coal is spouted direct to boilers from this silo.

This skip hoist, solved an ashes removal problem by avoiding difficulties such as rapid wear and excessive costs experienced with two previous installations. Ashes are discharged from a dump car at basement floor level, directly to the skip bucket which is automatically hoisted, dumped, and returned by push button control.

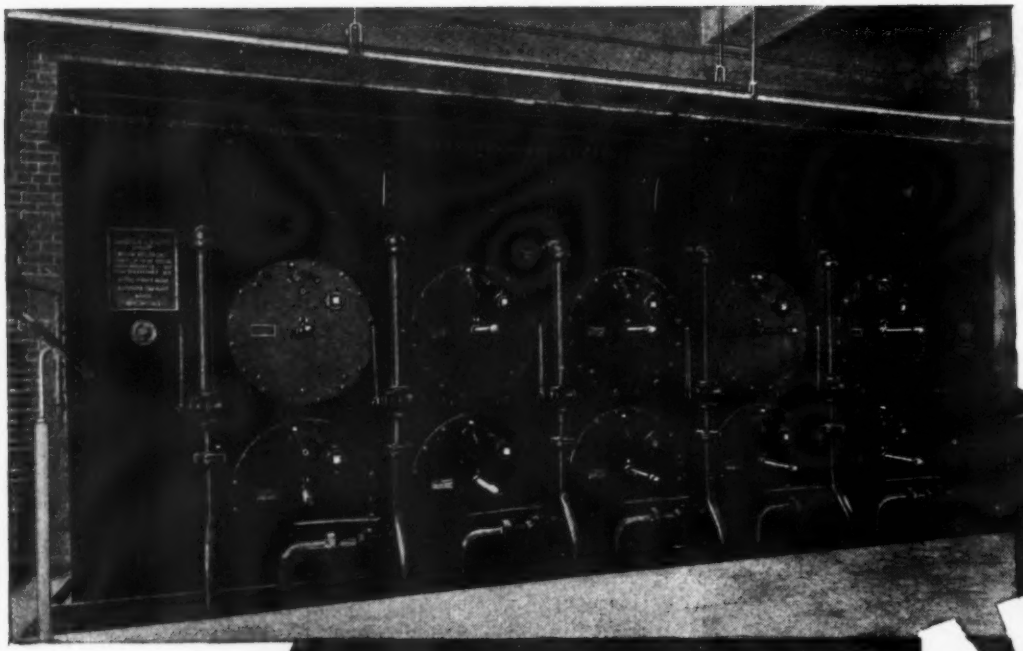


Mechanical handling of coal from concrete bin at one side of boiler room to stoker hoppers through this inclined Rotor Lift (screw) conveyor and horizontal distributing screw conveyor, completely eliminated a coal dust nuisance at an Indianapolis hospital. Both conveyors are operated from a 5 H.P. motor.

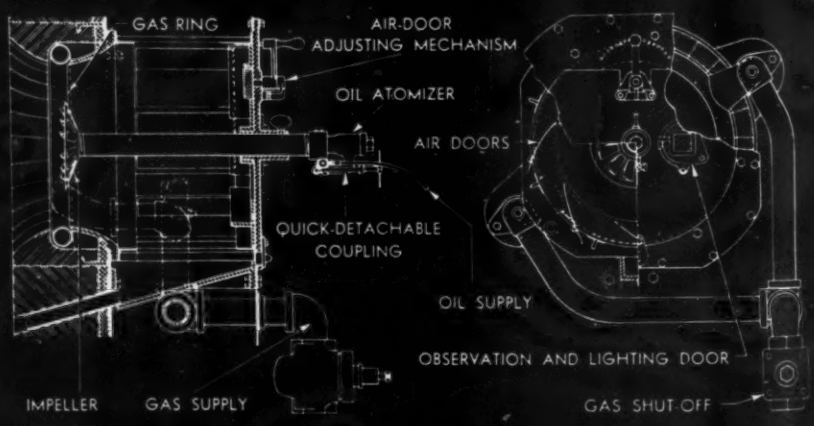
9664

Whether your plant is large or small, and no matter what your conditions might be, there is suitable Link-Belt equipment to meet every requirement. Before you do anything else about it, talk over your problem with an experienced Link-Belt engineer. Send for book No. 1510, "Solving the Problem of Coal and Ashes Handling."

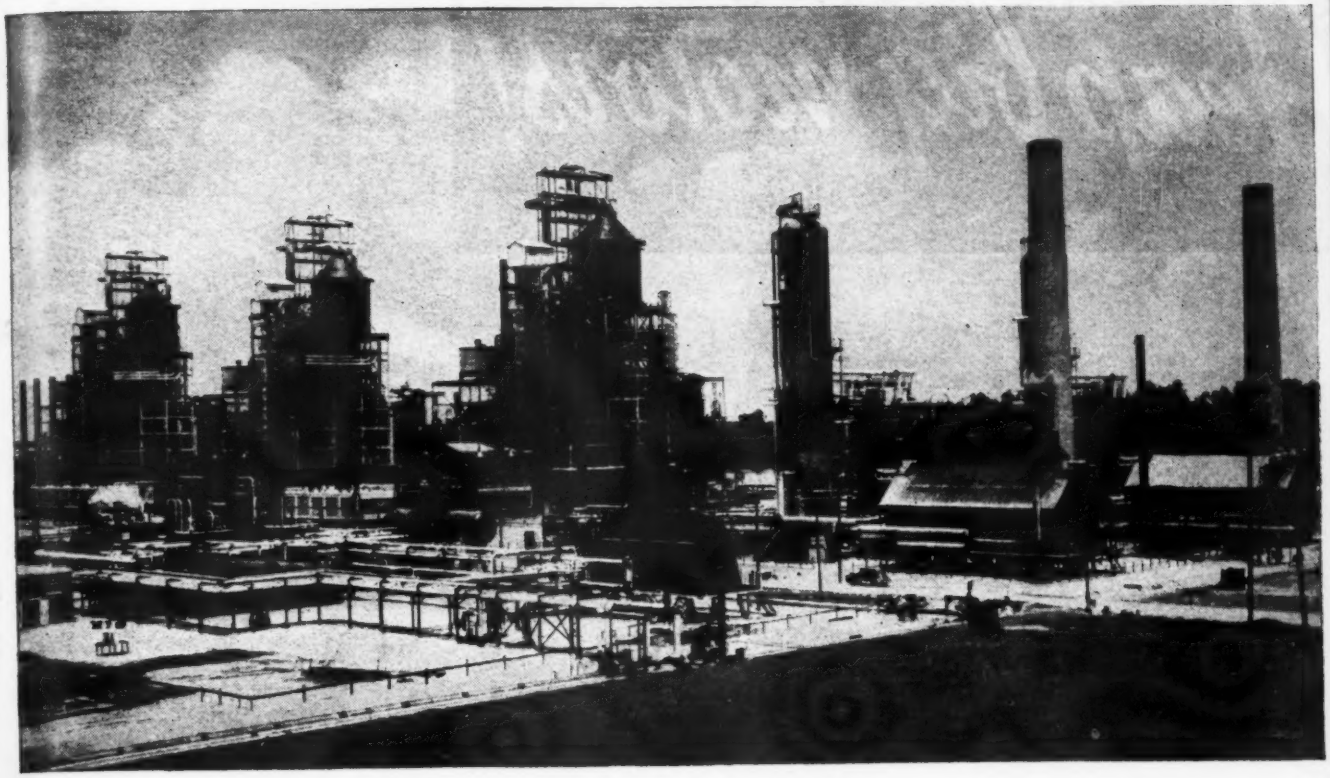
LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Toronto 8. Offices in principal cities.



THIS TEAM



Combination fuel gas and oil burners of this type are installed on boilers at Lake Charles.



Combination fuel gas and oil burners of this type are installed on boilers at Lake Charles.

Lake Charles

Six Babcock & Wilcox boilers help to provide power and process steam for the new giant Cities Service refinery at Lake Charles, Louisiana. Two are the B&W Integral-Furnace type, and teamed with them are 23 B&W burners on these and other boilers in the plant.

Providing tankfuls for task fliers calls for uninterrupted production . . . makes "steam up" as important as "on stream" . . . demands a high standard of efficient performance from generating equipment. B&W Integral-Furnace Boilers are a "known quantity", proved dependable in war industries as in pre-war services . . . now serving steel mills as well as refineries; arsenals and aircraft factories as well as butadiene plants.

Experience gained in unprecedented war-time assignments added to years of steam progress, will be reflected in the service of B&W Integral-Furnace Boilers to post-war industry.

BABCOCK & WILCOX

THE BABCOCK & WILCOX CO.

85 Liberty St., New York 6, N. Y.

BUY MORE WAR BONDS

G-276T

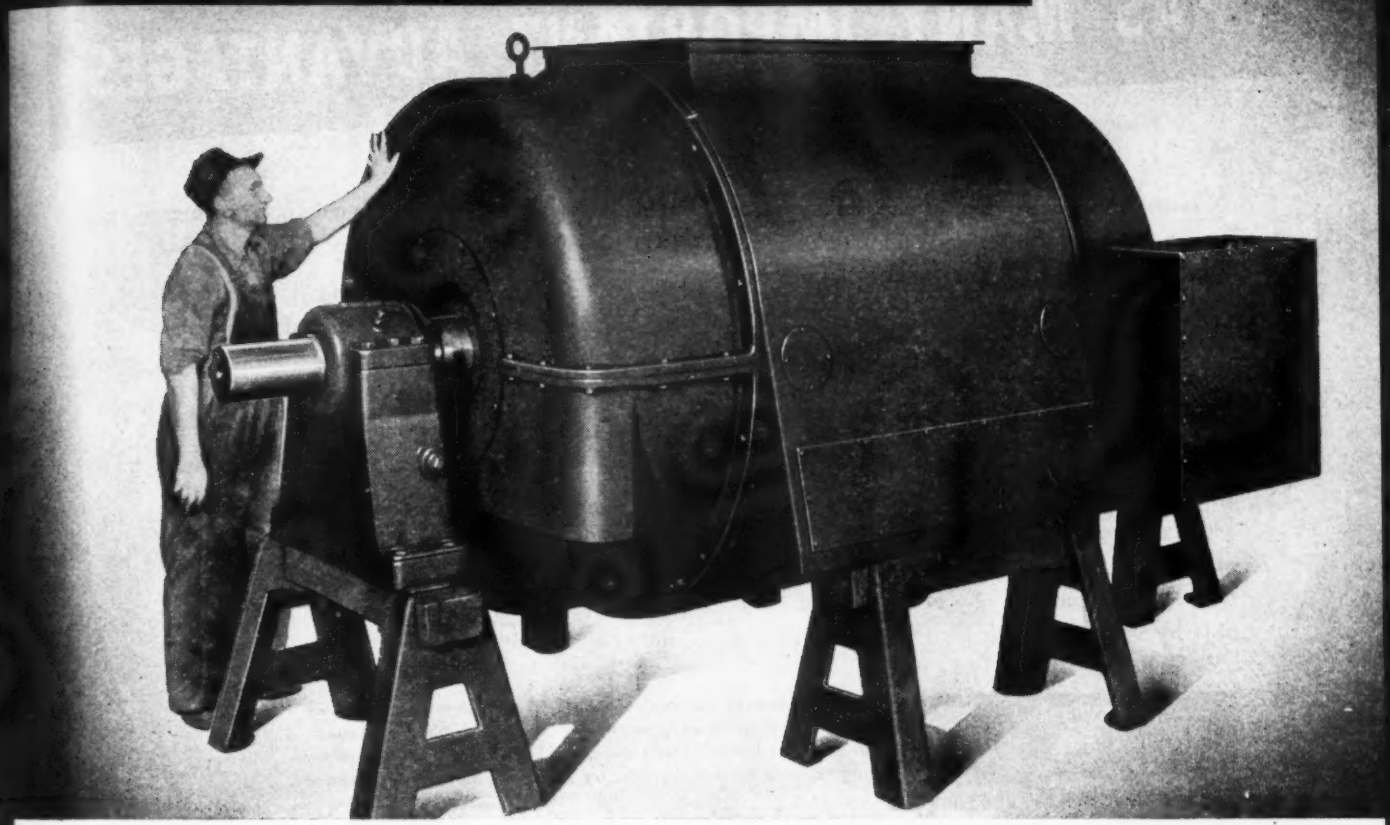
Heap big motors!

When you have a motor 17 feet in outside diameter, you've got something really big. These huge babies are built to drive tankers for the Maritime Commission. Here are the data: a 6600 hp, 93 rpm, 4000 volt, 3 phase, unity power factor synchronous motor —total weight of motor and shaft over 58 tons.

Size isn't everything, but — a shop that can build motors like these, can do a real job on any motor.

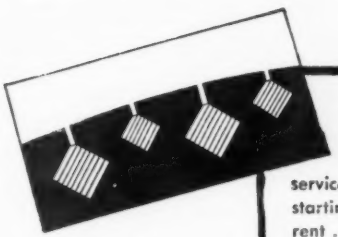
ELLIOTT

and heap fine motors too!



Another big one — a 2-pole synchronous job. It's 4000 hp, largest of its kind we have built to date — largest we've heard of, in fact. This one drives a gas exhauster on a vital war job.

These big high speed synchronous and induction motors that Elliott is building are getting themselves talked about, with favor, everywhere. If you are looking for that kind of motor it might be worth while to talk it over with Elliott engineers.



***Many of* these motors have**
ELLIOTT
DIAMOND CAGE CONSTRUCTION

An exclusive Elliott development, used where required by service conditions. It provides: High starting torque . . . Low starting current . . . Reduction in leakage of flux in synchronous motors . . . Most desirable ratio of cage resistance and most favorable relation of cage reactances . . . Close nesting of bars without sacrifice of strength . . . Eliminates looseness between rotor stack and bars . . . Exceptional strength, and stiffness of tip of stack . . . Aids quiet operation.

L-759

Company

Electric Power Department
RIDGWAY, PA.
DISTRICT OFFICES IN PRINCIPAL CITIES

STEAM TURBINES • GENERATORS • MOTORS • CONDENSERS
FEEDWATER HEATERS AND DEAERATORS • STEAM JET EJECTORS
CENTRIFUGAL BLOWERS • TURBOCHARGERS FOR DIESEL ENGINES
TUBE CLEANERS • STRAINERS • DESUPERHEATERS • FILTERS

DIAMOND *Automatic Sequential*

HAS MANY IMPORTANT ADVANTAGES

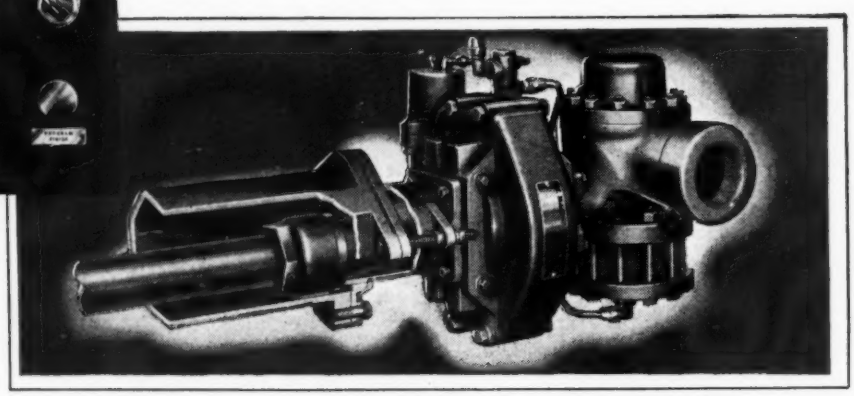
Description—All soot blower units on the boiler, superheater, economizer and air heater (whether fixed element, retracting or telescopic) are controlled from a single panel such as the one shown below. To begin the cleaning of the entire unit, simply press one button marked "start;" all blowers then operate in correct sequence without attention.

The soot blowers are usually arranged in groups; within each group, automatic sequential blowing of the units takes place. Any group can be operated independently of any other group if desirable by simply throwing a switch on the control panel. Blowing sequence of the units in any group can also be easily changed to suit conditions.

The compressed air for cleaning is discharged from the element nozzles in a series of short puffs. At each puff, the element is automatically repositioned. Spreading the cleaning cycle over a longer period of time permits use of a very small compressor.

The Diamond Automatic Sequential Soot Blower System has been in central station use on boilers as large as 900,000 lb/hr units since 1940. Its many important features are discussed on the right-hand page.

Program panel at left controlls both fixed and retracting blowers arranged in three groups; any desired number of groups can be had when system is designed. Entire soot blowing system is operated in correct sequence by simply pushing "start" button.



Shown above is the Diamond Air Puff Soot Blower having element permanently installed inside the setting; various types of retracting soot blowers are also used in the Diamond Automatic Sequential Air Soot Blower System.

DIAMOND POWER

AIR SOOT BLOWER SYSTEM

CORRECT CLEANING ASSURED — 1

The "human element" is entirely eliminated from soot blowing; the automatic sequential operation assures positive operation of each blower unit in correct sequence and at right speed every time. No blower unit can be overlooked by careless operator.

SAVES LABOR — 2

Automatic sequential operation eliminates need for an attendant to drain the piping, warm it up, and then operate each individual blower unit. On one medium size boiler this labor saving is estimated at more than $3000 per year.

NO FEED WATER MAKEUP — 3

Using compressed air instead of steam as the cleaning medium, there is no condensate loss due to soot blowing. This is particularly important where makeup water is a problem.

SAVES FUEL — 4

Experience gained during several years' operation on a number of installations indicates that automatic sequential air puff soot blowing uses only ⅓ to ⅔ of the energy from the coal pile that is needed for steam blowing.

ELIMINATES STACK DISCHARGE NUISANCE — 5

Intermittent operation expels the soot from the boiler in small quantities that are readily handled by the dust collector. In an installation without dust collectors, it has permitted daylight blowing in a metropolitan district having a smoke abatement ordnance.

REDUCES MAINTENANCE — 6

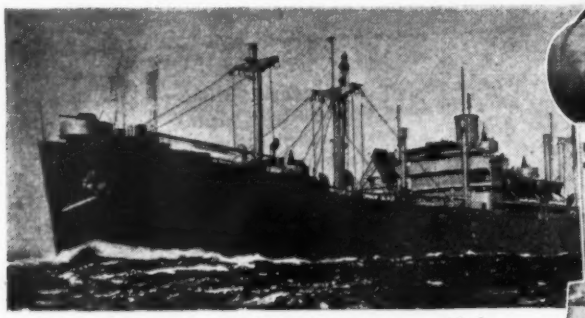
Experience on two 900,000 lb/hr boilers placed in operation in 1940 and one 900,000 lb/hr and one 550,000 lb/hr units installed in 1942 has proved the maintenance cost is unusally low.

Among the other advantages is the theoretically better cleaning with air from a given nozzle because of the greater density of air. If you are interested in further information, ask for Bulletin No. 956 which illustrates and describes an installation of Diamond Automatic Sequential Air Puff Blowers in a prominent eastern central station.

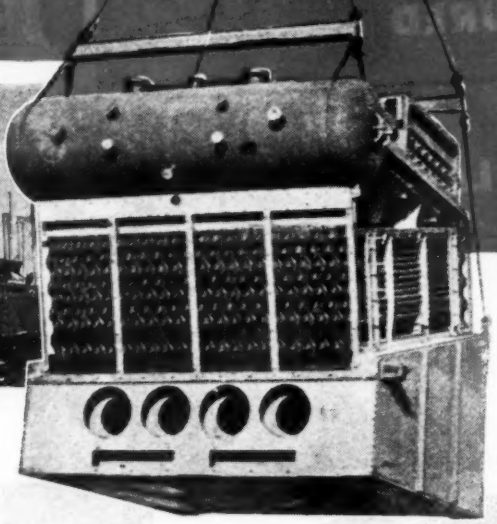
SPECIALTY CORP. • DETROIT 31, MICHIGAN

DIAMOND SPECIALTY LIMITED • Windsor, Ontario

"Wolfhounds" and



Greater power and speed have been provided by the Victory Ship



A boiler ready for installation in a Liberty Ship

A powerful 1940 Fletcher Class Destroyer plows forward

Destroyer Escorts like this are rough on "wolf packs"

The answer to fast wartime ship production—the Liberty Ship

One of the many "flat-tops" that serve as roosts for our wolf-killers of the air.

Official U. S. Navy and Maritime Commission photos

"Work Horses" of the Sea

TUBED WITH ELECTRUNITE

Once the fearful "wolf packs" of Nazi submarines exacted a terrible toll from Allied shipping convoys crossing the Atlantic. But not now! Today, destroyers, destroyer escorts and planes from baby aircraft carriers—the "wolfhounds" of the sea—hunt out and destroy them.

Once there was a serious shortage of cargo ships to transport weapons and supplies to our armies abroad and to our Allies. But new Liberty Ships, Victory Ships and C-Series freighters—the "work horses" of the sea—now carry thousands of tons of cargo to all parts of the world.

In these, and other types of vessels, many of the boilers are tubed with Republic ELECTRUNITE Boiler Tubes.

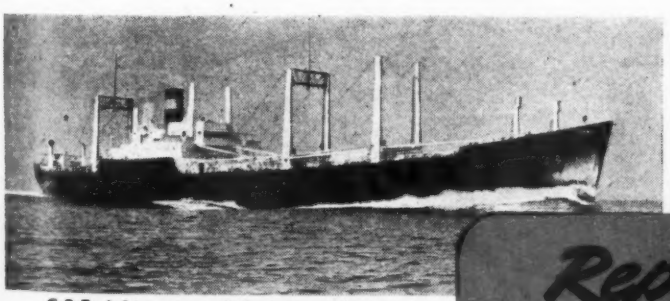
Thus, ELECTRUNITE Tubes are demonstrating during the severe service of wartime that they are just as safe, sound and economical in marine service as they have been proved by more than 120,000,000 feet in central station, industrial, railroad and all other types of steam generating and heat transfer equipment.

ELECTRUNITE Tubes are easy to install and long in service life because they possess the uniformity obtainable only through the exacting methods by which they are made. They are uniform in wall thickness, diameter, concentricity, strength, weight, ductility and scale-free surface.

They meet all standard specifications, including those of the U. S. Navy and Federal Government. Every tube is rigidly tested before shipment. Every tube is full normalized throughout.

Would you like to know more about these cost-cutting boiler tubes and how they can save you money? Write us for the full story.

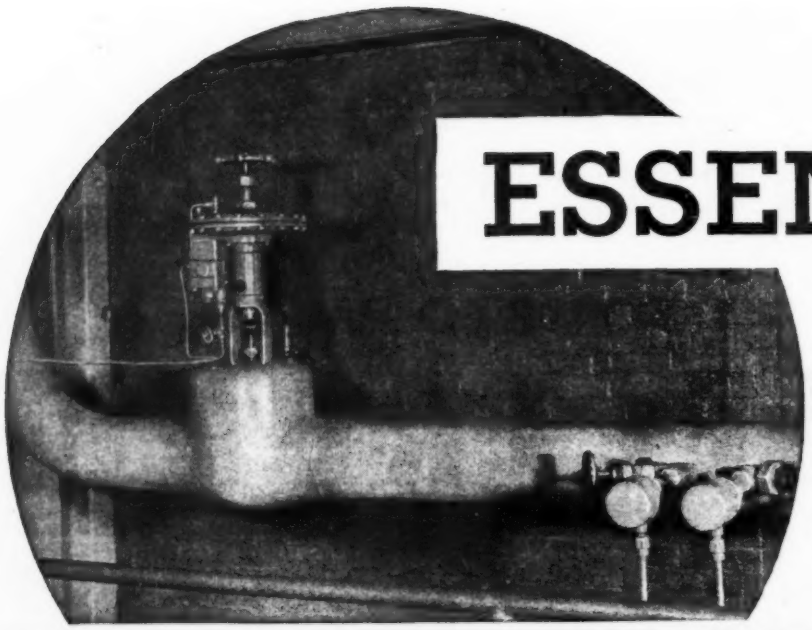
REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Berger Manufacturing Division
Culvert Division • Niles Steel Products Division
Union Drawn Steel Division • Truscon Steel Company
Export Department: Chrysler Building, New York 17, N. Y.



C-2 Freighter—one of the top-ranking cargo vessels of the world

SH-H-H!
DON'T SPREAD WAR INFORMATION—
IT MAY HELP THE ENEMY

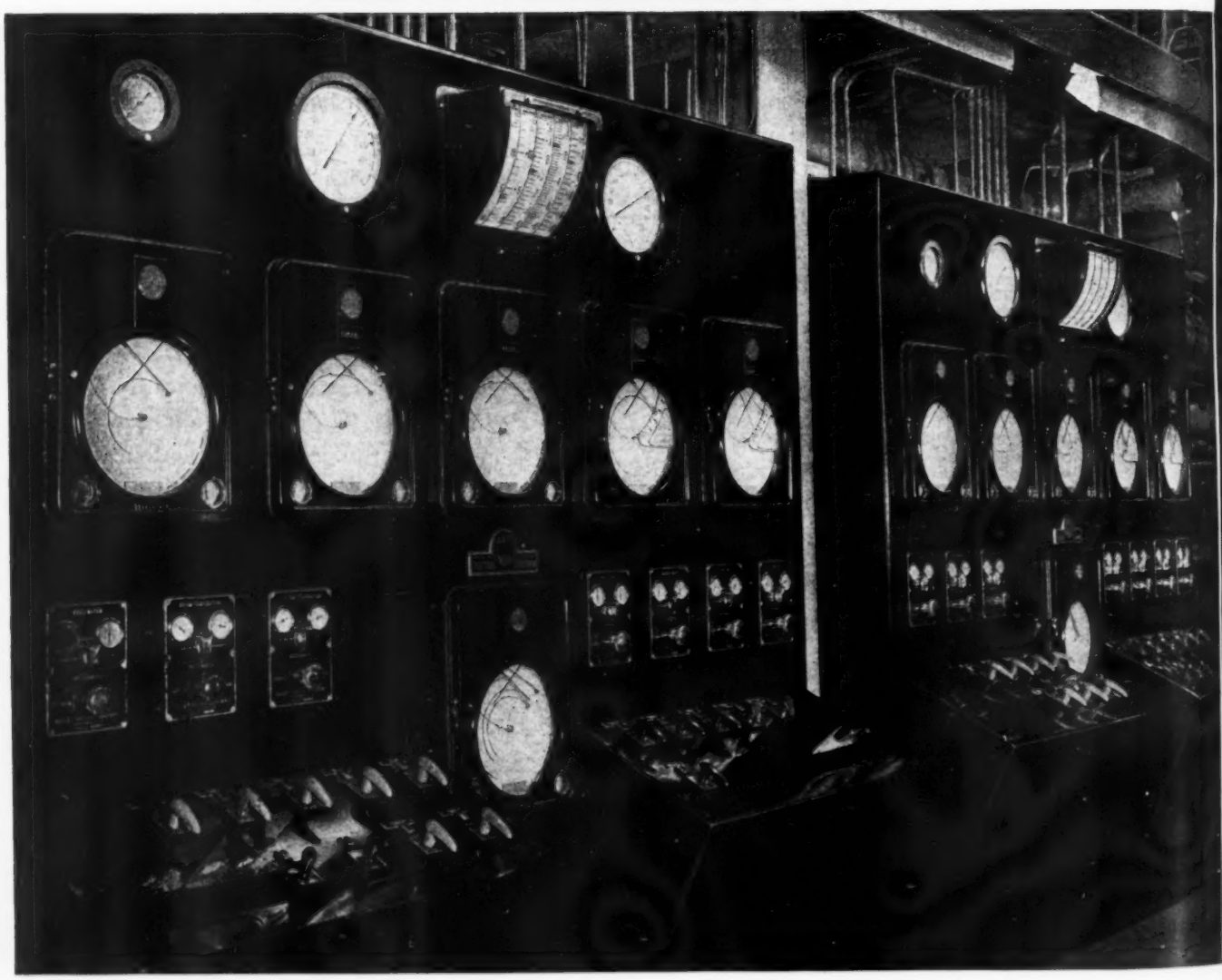
Republic
ELECTRUNITE
Reg. U. S. Pat. Off.
BOILER, CONDENSER AND HEAT EXCHANGER TUBES



ESSENTIAL

Bailey Feed Water Control Valve

Bailey Boiler Control Panels for two 135,000 lb. per hour capacity, oil and gas-fired boilers in a Western Power Station.



BAILEY METER CONTROL

BOILER METERS • MULTI-POINTER GAGES • FLUID METERS • RECORDERS • SUPERHEA

IN *WAR,*

PROFITABLE IN *Peace*

Bailey Boiler Control Conserves Fuel, Insures Safety, Increases Turbine Efficiency, Improves Continuity of Service and Simplifies Training of Operators . . . . .

The same qualities of Bailey Boiler Control which make essential in wartime power plant operation, make it profitble to use in peacetime operation.

conserves fuel and fuel transportation facilities by autoatically maintaining the correct fuel—air ratio for efficient ombustion at all times.

insures against accidents to operators and equipment by:

- Accurate control of boiler water level, steam temperature and fuel—air ratio.
- Interlocks to insure the proper sequence of operation.
- Limiting devices to prevent operation under unstable conditions.
- Alarms to warn operators of dangerous conditions such as high or low water level, flame failure, loss of air pressure, etc.

increases turbine efficiency by supplying steam at design ressure and temperature at all times.

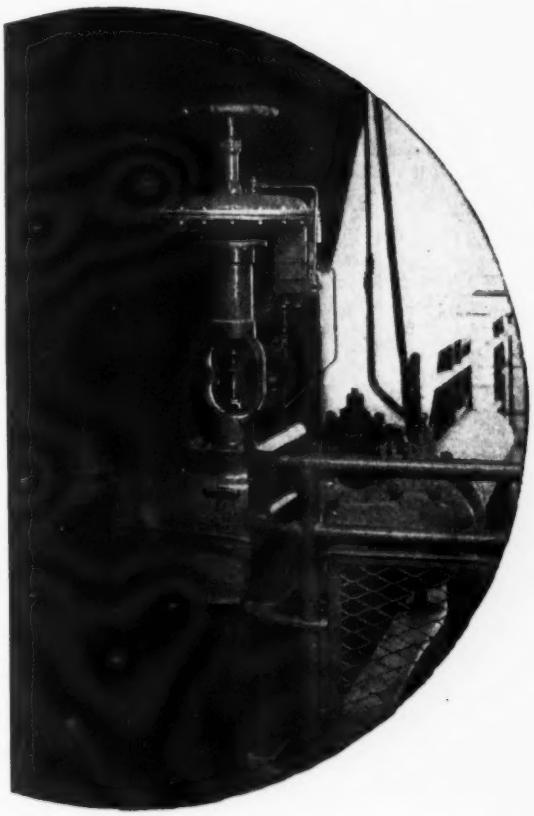
improves the continuity of service by reducing furnace nd boiler repairs.

simplifies training of new operators and insures conuous economy during the training period.

hese same qualities of Bailey Boiler Control which are ow helping to win the war will help American industry to in the peace.

uggestions for wartime boiler plant operation are given our Bulletin No. 16 "How to Safely Stretch Steaming apacity." Ask for your copy now.

A-90



Bailey Gas Flow Control Valve.

BAILEY METER COMPANY

036 IVANHOE ROAD • CLEVELAND, OHIO

Bailey Meter Company Limited, Montreal, Canada

. . *he Complete Combustion Control System*

TROL • DESUPERHEAT CONTROL • COMBUSTION CONTROL • FEED WATER CONTROL

Boilers for the

A new concept in power generation made its appearance with the "Unit Power Plant" developed by Westinghouse Electric International Company.

This compact, effective steam-electric generating unit, adaptable to operation in any part of the world and under all climatic conditions, is built to standardized designs, permitting it to be broken down into relatively small packages for ready transportation to inaccessible plant sites. Special emphasis is placed on durability of equipment and simplicity of operation.

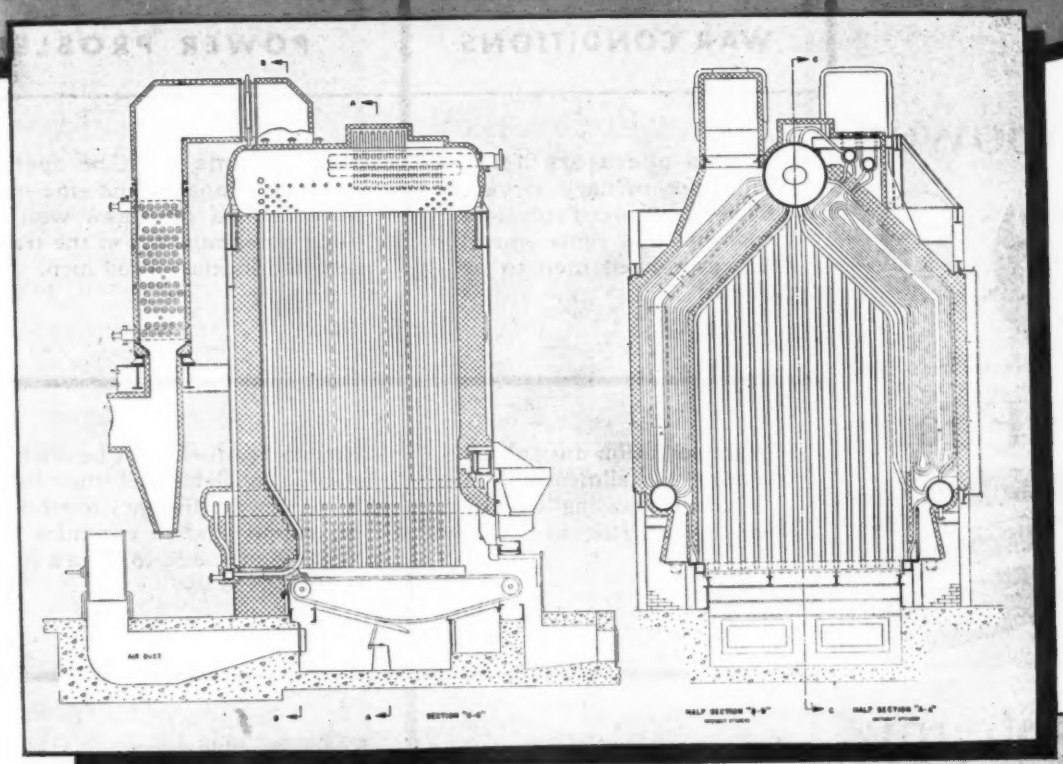
Many of these Unit Power Plants are already under way for China and Russia, for installation on the hot reaches of the upper Yangtze river to the arctic steppes of northern Siberia.

A study of the various boiler designs available for this severe duty led to the selection of Foster Wheeler type S-A steam generators for thirty-seven plants, the record showing that "all parties agreed upon this boiler as best adapted to meet the peculiar design, erection and operating conditions involved. Its compactness, freedom from unmasked refractories, adaptability to a variety of fuels, methods of firing and its free circulation influenced the selection."

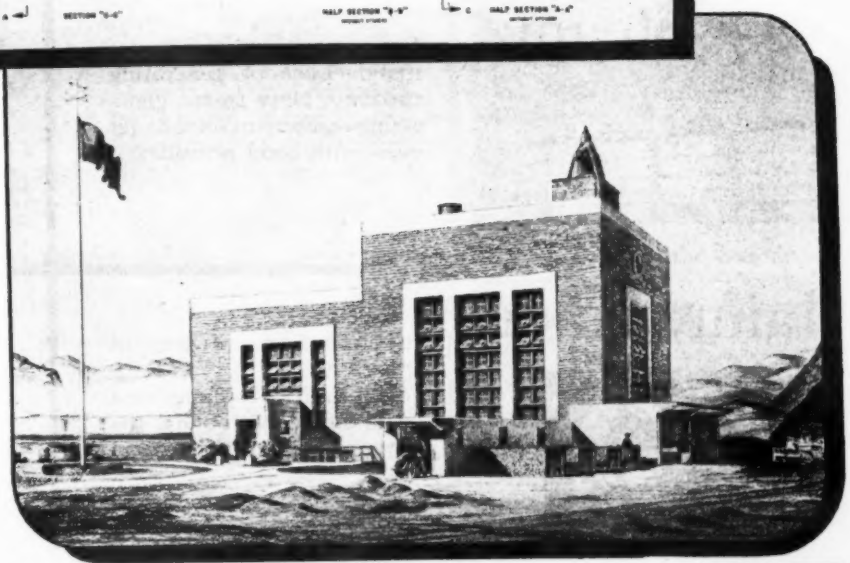
FOSTER WHEELER CORPORATION, 165 BROADWAY, NEW YORK 6, N. Y.

FW FOSTER

UNIT POWER PLANTS



S-A steam generator for China

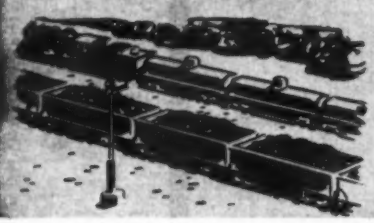


Architect's drawing of "Unit Power Plant" for Russia

Foster Wheeler is a four star wnner under the U. S. Navy Board of awards for production.

WHEELER

First Aid Chart

	WAR CONDITIONS	POWER PROBLEMS
Manpower	Skilled operators being called for military service. Fewer experienced operators available for replacement. Inexperienced men to be trained.	Power plants must be operated at maximum capacity and efficiency with fewer skilled operators who, at the same time, must aid in the training of new and inexperienced men.
Fuel 	Transportation difficulties threaten curtailment of fuel shipments causing temporary fuel shortages.	Emergency fuel must be obtained and stored. Available fuel must be burned at maximum efficiency to stretch present supply and to minimize haulage. Must be prepared to burn a substitute fuel if necessary.
Steam	Big increase in steam demand. Lack of generating capacity. New steam generating equipment hard to get even with good priorities.	Every possible pound of steam must be squeezed from present generating units to meet new load demand. Process steam waste must be checked and held to a minimum.
Maintenance	All equipment operating at overload. No stand-by equipment. Replacement parts difficult to obtain. Inexperienced operators.	Maintenance and repairs must be taken care of promptly, in spite of a shortage of experienced maintenance men or difficulties in getting materials, in order to avoid major shut-downs.

REPUBLIC
INSTRUMENTS
AND CONTROLS

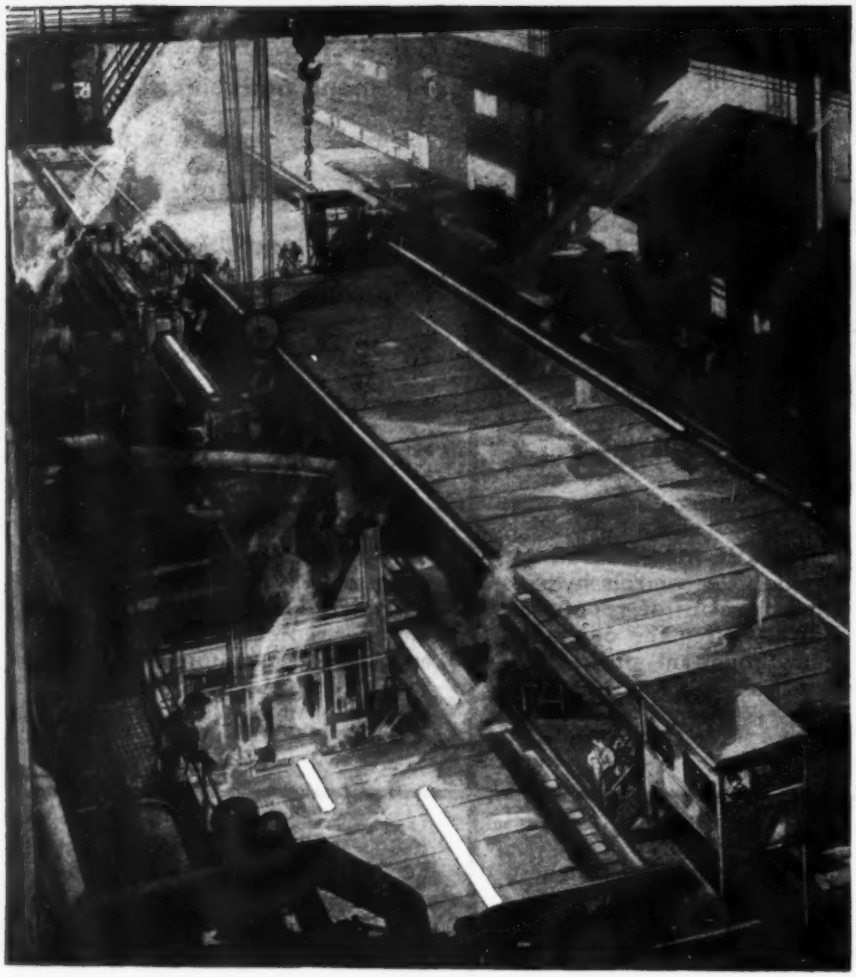
FOR SOLVING WARTIME POWER PLANT PROBLEMS

THROUGH the use of instruments and controls you may be able to increase your steam supply just enough to get it over the peak. Republic engineers will be glad to consult with you. Write to us today.

INSTRUMENTS	BOILER CONTROLS	PROCESS CONTROLS
IMPROVE SUPERVISION Instruments provide operators with continuous indications of operating conditions. Permit centralized supervision of all operating factors. Provide continuous record of performance.	**CONSERVE MANPOWER** Automatic boiler controls, by performing the routine repetitive adjustments, free the operators for more important supervisory duties.	**STRETCH SKILL** Automatically perform routine repetitive adjustments to maintain desired conditions thereby enabling the operator to supervise the operation of a larger number of units.
CHECK LOSSES CO_2 meters, draft gages and flue gas temperature recorders provide a continuous check on combustion efficiency and preventable heat losses. Steam meters serve as a guide for the proper load distribution among boilers.	**SAVE FUEL** Automatically maintain highest combustion efficiency by controlling fuel and air input, in a fixed predetermined ratio, over the normal load range. Provide for changes in fuel characteristics and other operating factors.	**REDUCE WASTE** For every pound of steam wasted and for each extra gallon of watar pumped, etc., a corresponding amount of fuel had to be consumed in the boiler room. Automatic controls reduce power waste and thereby save fuel.
CHECK STEAM WASTE Meters installed on main distribution lines will immediately center attention on the department or unit using excessive amounts of steam. They provide the information needed to coordinate steam consumption with steam production.	**TEST EFFICIENCY** Produce maximum steam output at test efficiency by maintaining constant steam pressure, maximum combustion efficiency, constant and correct furnace draft and desired load division among boilers.	**MORE STEAM** By reducing the power consumption of pumps, compressors, dryers or other steam consuming units, through the use of automatic controls, you increase the effective capacity of your power plant.
LOCATE TROUBLE SPOTS Instruments, by providing a check on the performance of various units, are invaluable in spotting potential trouble spots before they develop to a point where they require extensive repairs and interfere with production.	**REDUCE OUTAGES** Correct boiler operation reduces outages. Boiler controls, by coordinating all operating factors, prevent the chain-of-events type of trouble that may lead to serious shut-downs.	**UNIFORM PERFORMANCE** Maintain correct process conditions under continuous operation at peak capacity. When both operators and equipment are working at capacity close control is vital to prevent serious maintenance outages.

Republic Flow Meters Co.

2222 Diversey Parkway • Chicago, Illinois



ROLLING STEEL FOR WAR

YET READY FOR PEACE

Watching the white-hot bars of steel run the course of this modern continuous bar mill — going faster and faster, growing longer and longer — stimulates pride in war steel production in America and gives assurance of an abundance of steel for use in a world at peace.

For this unique J&L bar mill — as well as other bar mills throughout the industry — is as adaptable as steel itself; the strongest, most versatile metal. Without change of pace, the rhythm of its rolling took up the song of steel in battle: steel for planes, tanks, shells, ships and guns.

At war's end these mills will keep on rolling steel — without pause for conversion — steel bars for automobiles, for railroads, for industry, for farms — new and better steels for daily living and employment.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

J&L STEEL

CONTROLLED QUALITY STEEL FOR WAR

STEEL MILL MUSIC

Steel mill music is a thunderous, rumbling of overtones and undertones in a big, modern rolling mill that blend into a roaring symphony. To a visitor, it is just a deafening noise, but to the skilled crews that operate the mill it has a definite rhythm. If the workmen at their posts hear the faintest dissonance, each man is instantly alert to find out quickly what is causing the discord, as it may signal something amiss. Ears trained by years of listening to steel mill music can spot an off-beat in the great rhythmic noise as quickly as a conductor can spot one in a big orchestra.

World record for steel bars from any bar mill, 44,125 tons in one month, was rolled on the Jones & Laughlin No. 18 mill (see illustration) in January this year, a tribute to highly skilled workmen who operate it, and to J&L engineers who in 1931 pioneered in designing the new type mill.

A deep rose-red glow illuminates rolls, men and interior of this unique J&L 14-inch bar mill as red-hot billets being rolled into rounds, flats, hexagons, squares and special shapes speed through several stands of rolls on their way up and down and across the mill's great expanse (large enough to cover five football fields). This mill is so vast that as many as twelve steel sections are in process at one time — totaling at finish as long as ½ mile — and so fast that time from billet to finished bar is less than two minutes.

Iron works on a flat boat is what the astonished citizenry along the Monongahela River in 1850 saw being pushed by a steamboat down the 60 miles from Brownsville to Pittsburgh. The iron works belonged to twenty-six year old B. F. Jones. He had purchased the plant with his earnings as a partner in a canal boat freight service. Young Jones dismantled his furnaces and mill and transported them to Pittsburgh, foreseeing the development there. This was the beginning of the Jones & Laughlin Steel Corporation, today fourth largest steel producer.

Conestoga freight wagons, and canal boats transported to eastern markets the puddled iron bars, flats, plates, shapes, bands, cold rolled iron bars, and cut nails that in the 1850's were the pioneers of a long line of J&L products to follow.

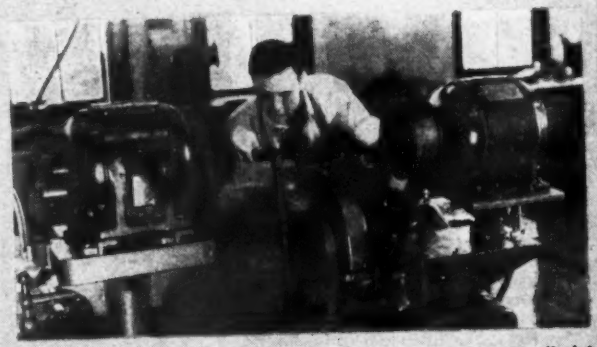
Stoutly Dutch-built in a valley in eastern Pennsylvania once occupied by Conestoga Indians, the blue and red Conestoga wagons with rakish, overshot canvas tops, were pulled across the rugged trails of the Alleghenies by 4- and 6-horse teams hauling freight.

Stogies, a popular smoke to this day in the Pittsburgh district, were long, thin, black cigars brought west from tobacco plantations in eastern Pennsylvania by Conestoga wagon drivers, who hauled back iron products. These stout smokes were called "Conestogie" cigars, soon shortened to stogies.

SHORTS STYMIED

Voltage surges which accompany switching and frequent starting and stopping of motors impose high dielectric stresses on the coil insulation, and can cause harmful short circuits. Yet this is an unavoidable condition of service for many motors.

The grinder shown here, for example, starts and stops every time a finished part is removed and a new part inserted. But the two Tri-Clad motors that drive it have been built to withstand safely the voltage surges ordinarily encountered in this type of service. Their ability to "stymie" shorts was proved by *the new General Electric test* described below.



External grinder, equipped with two Tri-Clad motors, installed in the milk-machinery manufacturing plant of the Rite-Way Products Company, Chicago, Ill.

New high-potential, electronic surge-tester verifies strength of TRI CLAD motor windings

This electronic test of insulation makes a "cardiogram" of every Tri-Clad motor winding, ferreting out weaknesses that might lead to shorts caused by voltage surges in service. It tests each turn, coil, and phase group of the windings for adequate insulation strength to withstand the "steep front" high-voltage surges of actual service. First developed and applied by G.E., it's one of the production tests which all Tri-Clad motors must pass as they come off our production lines. — *General Electric Company, Schenectady, N. Y.*

GENERAL ELECTRIC

TRI CLAD MOTORS

Each week 192,000 G-E employees purchase more than a million dollars' worth of War Bonds.

TO HELP YOU MEET

COMBUSTION ENGINEERING

VU

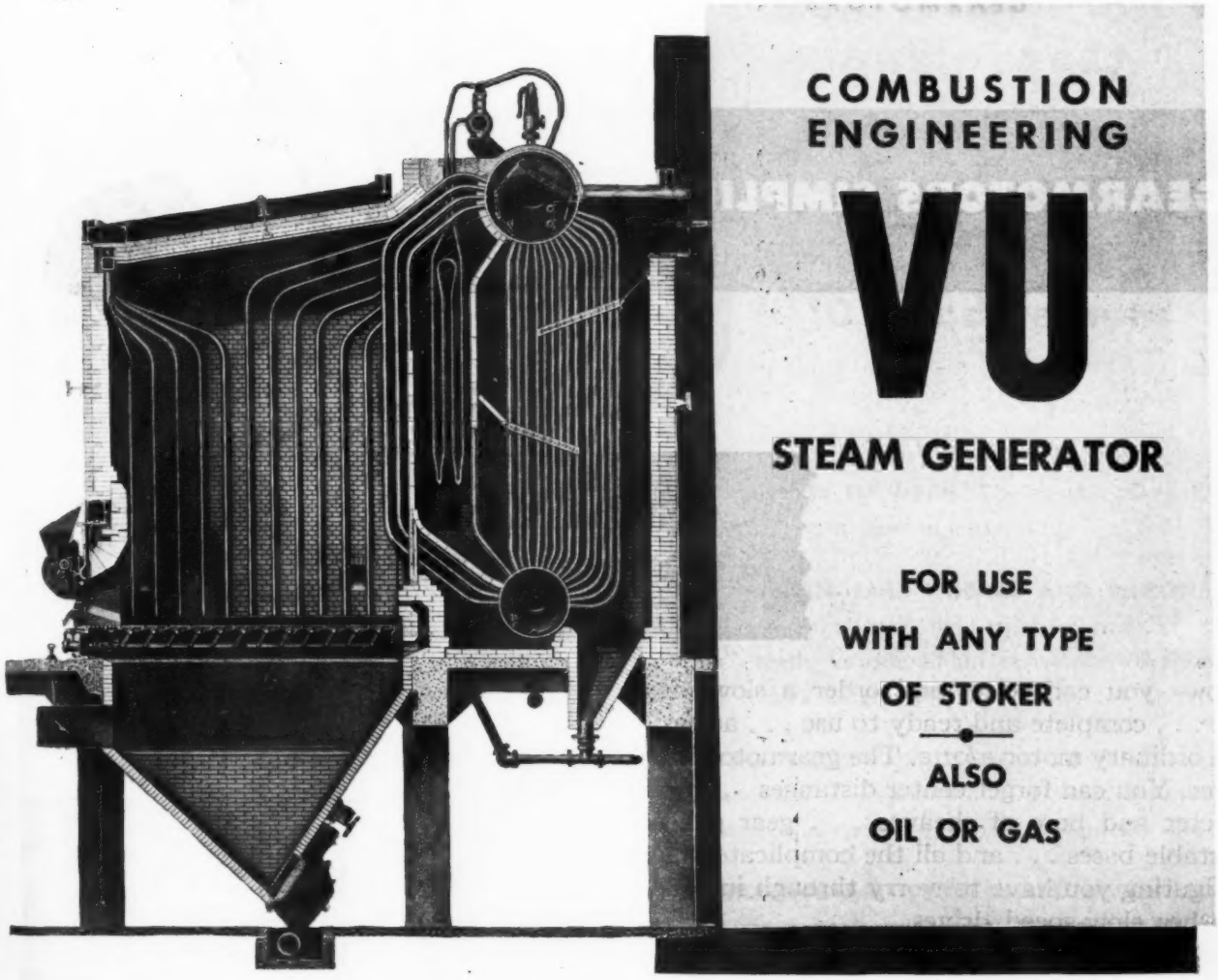
STEAM GENERATOR

FOR USE WITH
PULVERIZED COAL,
OIL, GAS OR COMBINATIONS
OF THESE FUELS

There may still be many unanswered questions to post-war business conditions, but there's o thing of which we can be certain — competition going to be keener than ever, and low-cost produ tion will therefore be of the utmost importanc Steam for heating, power and process enters su stantially into the cost of virtually all products from gadgets to heavy equipment, yet the va majority of American manufacturers are still hand capped by high steam costs. Here, then, is a b opportunity for alert engineers to make a real co tribution to the lower production costs their manag ments will need to meet post-war competition. T such engineers we suggest investigation of the re duced steam costs obtainable with Combustio Engineering's Type VU Steam Generator.

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND A

POST-WAR COMPETITION



Reasons for the Economy of this C-E Unit

There are two principal reasons for the economy of the VU Steam Generator:

• **HIGH EFFICIENCY:** VU Units in the smaller capacity range, stoker fired and without heat recovery equipment, operate at efficiencies in the neighborhood of 80 per cent, depending on type of stoker and fuel. The larger VU Units with heat recovery equipment operate at efficiencies up to 88 per cent. These are not test efficiencies, nor optimistic claims; they are figures taken from average monthly records of users.

• **LOW MAINTENANCE AND OUTAGE:** Ability to stay on the line for long periods means low maintenance and avoidance of serious outage losses. Many users of VU Units have reported exceptional service records. Here are a few recent ones: "works around the clock, 7 days a week for months on end until we shut down for scheduled inspection" . . . "in continuous operation for 9 months since first placed in service" . . . "two units, on the line 97% of all the time for a year."

Further evidence of the efficient, economical performance of VU Units is their wide acceptance throughout the world. Not only are there hundreds of installations in the United States and Canada, but also in Arabia, China, Russia and other remote regions where equipment *must* be good because service engineers are not available.

VU Units will give you the overall economy you will need to meet post-war competition coupled with high fuel costs. Then you will find that the best equipment you can get is the least expensive. A-825

Combustion C-E Engineering

200 MADISON AVENUE NEW YORK 16, N. Y.

REASON NO. 2

FOR USING

GEARMOTORS

GEARMOTORS SIMPLIFY SELECTION

ORDERING

DELIVERY

Now—you can select and order a slow-speed drive . . . complete and ready to use . . . as easily as an ordinary motor *alone*. The gearmotor is the answer. You can forget center distances . . . pitch diameter and bore of sheaves . . . gear guards, adjustable bases . . . and all the complicated data and figuring you have to worry through in ordering other slow-speed drives.

The gearmotor combines prime mover and speed reducer in a single compact unit . . . motor and gears are *matched* to the job.

Because you spend much less time selecting and ordering the *right* speed reduction equipment—the gearmotor gets onto the job and into production sooner.

Ask your Westinghouse representative about this and many other basic gearmotor advantages. All of these are discussed in detail in new gearmotor handbook, "Gearmotor Applications". A copy will be sent on request. Ask for B-3218. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N. J-07219

REASON NO. 1—GEARMOTORS SAVE SPACE

Third of a series sponsored by Westinghouse to promote the use of gearmotors.

The New Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Type C—A double-reduction unit for standard ratios from 7.6:1 to 25.7:1, inclusive.
Type A—This single-reduction gearmotor is available in standard gear ratios from 1.22:1 to 6.25:1, inclusive.
Type E—Double-reduction gearmotor available in standard ratios from 31.2:1 to 58.3:1, inclusive.
Gearmotors

WHY USE WESTINGHOUSE GEARMOTORS?

. . . check these 10 good reasons

1. FEWER PARTS TO WEAR. The simple, efficient, design uses a minimum of moving parts.

2. BPT "TOUGH-HARD" GEARS AND PINIONS. This exclusive Westinghouse heat-treating method "tough-hardens" teeth for maximum resistance to shock and impact—means longer wear.

3. USE ALL WESTINGHOUSE MOTOR TYPES—open . . . totally-enclosed . . . splashproof . : . explosion-proof—to meet changes in operating conditions quickly and easily.

4. INTERCHANGEABILITY OF PARTS between unit types reduces your parts' replacement stock by 40%.

5. HIGH EFFICIENCY of gearing parts assures full motor horsepower at output shaft . . . only 2% power loss per gear set.

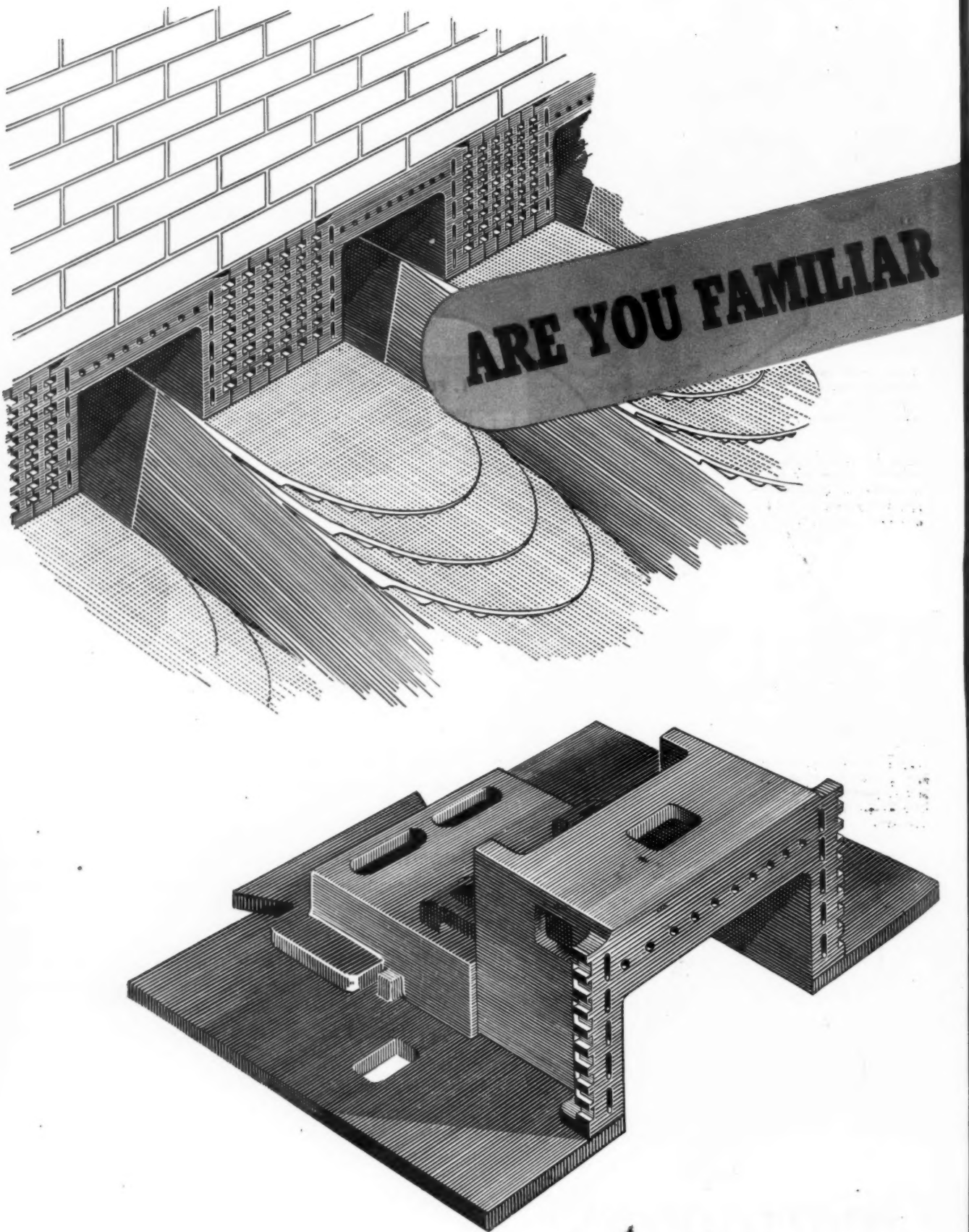
6. POSITIVE LUBRICATION of gears and bearings by automatic splash system reduces probable maintenance to twice-a-year change of oil.

7. EASY ACCESSIBILITY. Gearing parts can be readily inspected or easily removed to make gear ratio changes.

8. IMPROVED FOUNDATION STABILITY. Feet are under the gear case . . . placing support next to the gearmotor load. Each foot is reinforced by external ribs.

9. UNIT RESPONSIBILITY for design . . . manufacture . . . and service. Westinghouse builds both motor and the gears.

10. MEET A.G.M.A. STANDARDS. The new Westinghouse Gearmotors are specifically designed and built to meet A.G.M.A. standards . . . easy to order and match to the job.


ARE YOU FAMILIAR

TH ALL THESE FEATURES of the

FRONT WALL AIR BOX?

TAYLOR Front Wall Air Boxes and air cooled ram box caps work together to spread a screen of air across the stoker front wall. This action reduces clinker and slag formations, cuts labor and material costs of front wall maintenance, adds to operational freedom and efficiency.

The Front Wall Air Boxes and Air Cooled Ram Box Caps, like other features, add to the efficient, reliable, low cost operation of Taylor Stokers in generating steam.

Taylor air boxes and caps provide for lower costs in five other ways:

1. Replacements, easily made, are confined to short narrow vertical bars.
2. The Hi-Angle ram box cap provides for better packing of fuel at the mouth of the retort.
3. The cap improves the contour of the upper section of the fuel bed.
4. An air box bar is an integral part, on each side, of the ram box cap extension. This adds strength and permits the sides to be air cooled.
5. Two hooks which form a part of the ram box cap extension not only make it secure, but reduce the labor required for replacement.

JUDGE THE SELECTION OF FUEL FIRING EQUIPMENT BY THESE TWELVE POINTS

1. **RELIABILITY**—the ability to operate with minimum outage and minimum standby equipment.
2. **CAPACITY**—the ability to provide adequate prime capacity ratings, with sufficient reserve capacity for emergencies.
3. **MAINTENANCE**—the ability to operate continuously with minimum repair costs.
4. **FLEXIBILITY**—the ability to follow the steam demand upward or downward . . . quickly and without sacrificing efficiency.
5. **EFFICIENCY**—the proved dollar efficiency (total cost of steam production) as shown by actual performance in similar installations.
6. **OPERATION**—the ability to operate continuously, the number and type of operations required, the ease of combustion adjustments, etc.
7. **ADAPTABILITY**—the ability to meet special and limiting conditions, present and future—structural limitations, utilization of present equipment, growth and change of power service demands.
8. **FUEL FLEXIBILITY**—the ability to burn efficiently and easily fuels from many sources having widely varying characteristics.
9. **REFUSE DISPOSAL**—the ability to economically eliminate ash or refuse and the opportunities of disposal at low cost, no cost, or profit.
10. **STACK DISCHARGE**—the practical elimination of "smoke nuisance" without special equipment.
11. **SPACE REQUIREMENTS**—the ability to conform to existing or future space limitations, to short and wide or long and narrow furnaces. Also the accessibility of component parts for maintenance and operation.
12. **OBSOLESCENCE**—the adaptability of the equipment toward possible future modernization with minimum of complication and outage.

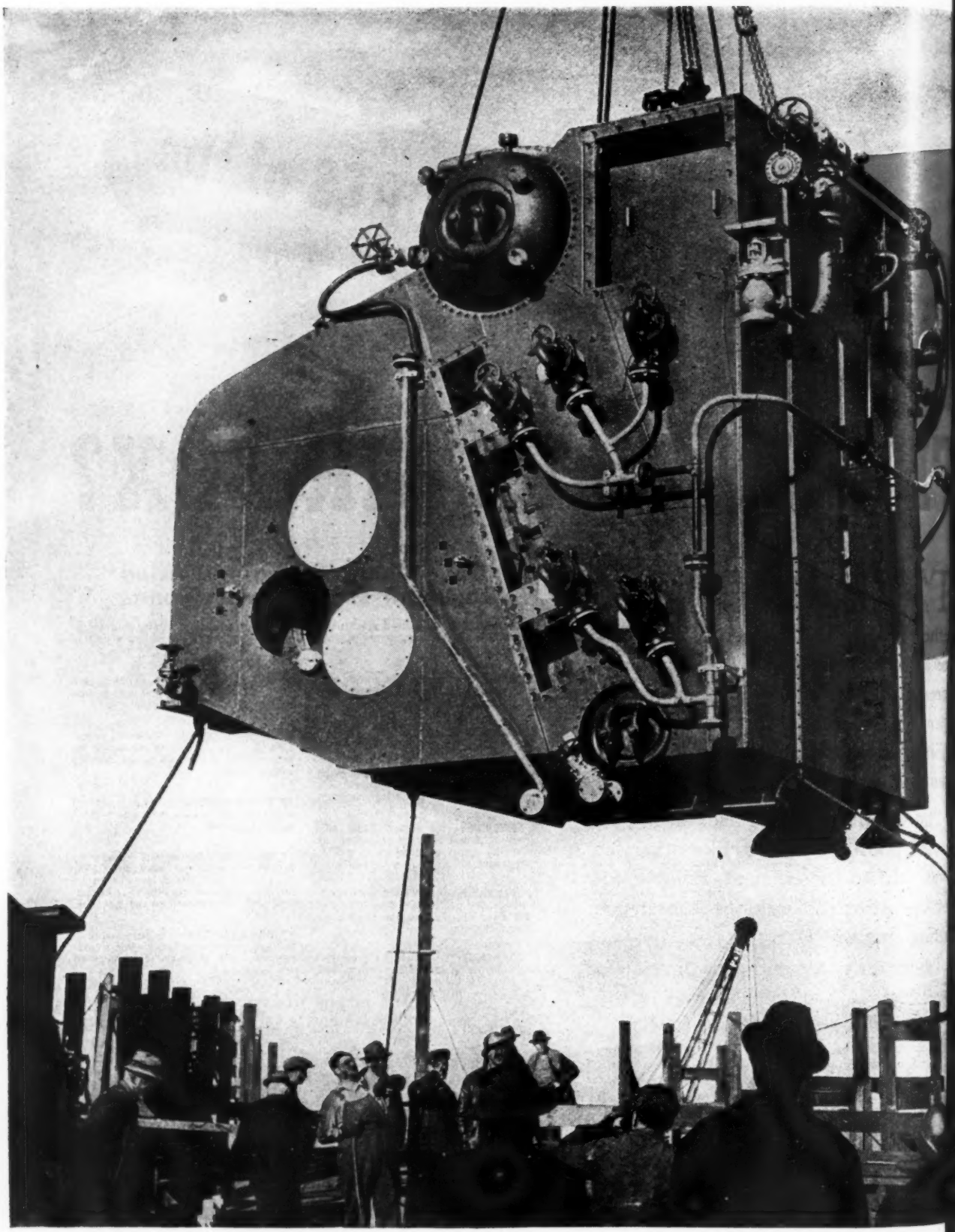
A-E-CO TAYLOR STOKERS • LO-HED HOISTS
HELE-SHAW FLUID POWER • MARINE DECK AUXILIARIES

A-E-CO TAYLOR STOKER

AE CO 75th ANNIVERSARY 1869

AMERICAN ENGINEERING COMPANY

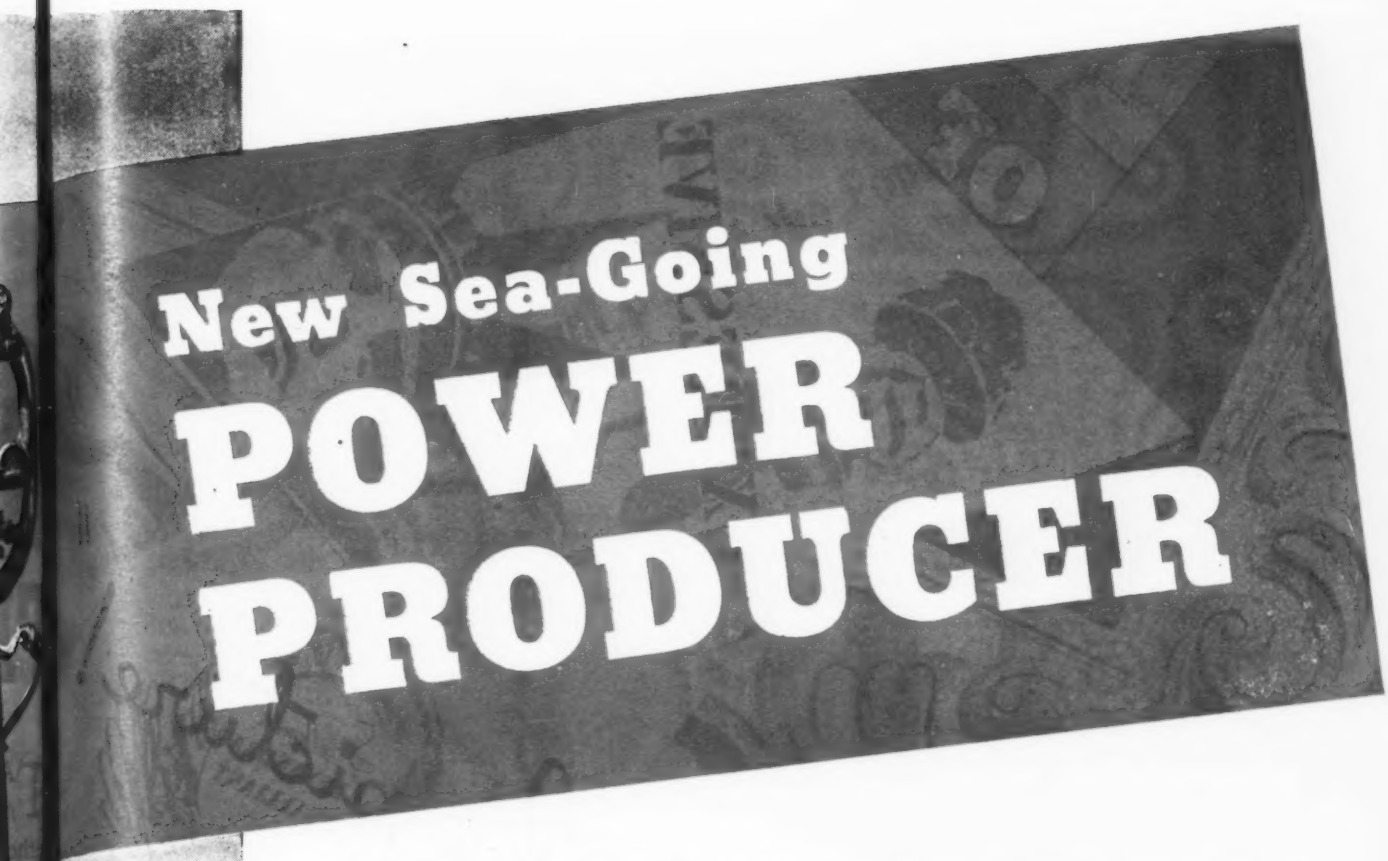
PHILADELPHIA 25 • PENNSYLVANIA



TEXACO

TEXACO

TUNE IN THE TEXACO STAR THEATRE EVERY SUNDAY NIGHT



New Sea-Going POWER PRODUCER

NOW off the secret list, 30-ton steam boilers of this new type are revealed as powering important units of the Navy's anti-sub fleet. In each vessel, two boilers team up to generate high-pressure steam for the turbine drive.

Efficient steam turbine operation whether on land or sea depends in large measure on efficient lubrication . . . the kind you get with *Texaco Regal Oils* (*R & O*).

Texaco Regal Oils (*R & O*)—a new high in preventing rust and oxidation—keep steam turbine systems clean, bearing temperatures normal, governor action smooth and sensitive. These oils free themselves rapidly from air and water, are highly resistant to gum formation and sludging.

Texaco lubricants have proved so effective in service they are definitely preferred in many fields, a few of which are listed below.

Texaco Lubrication Engineering Service is available to you through more than 2300 Texaco distributing points in the 48 States.

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

THEY PREFER TEXACO

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and railroad cars in the U. S. are lubricated with Texaco than with any other brand.

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

REGAL OILS (R & O)
FOR ALL TURBINES

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

Paper is part of the picture!

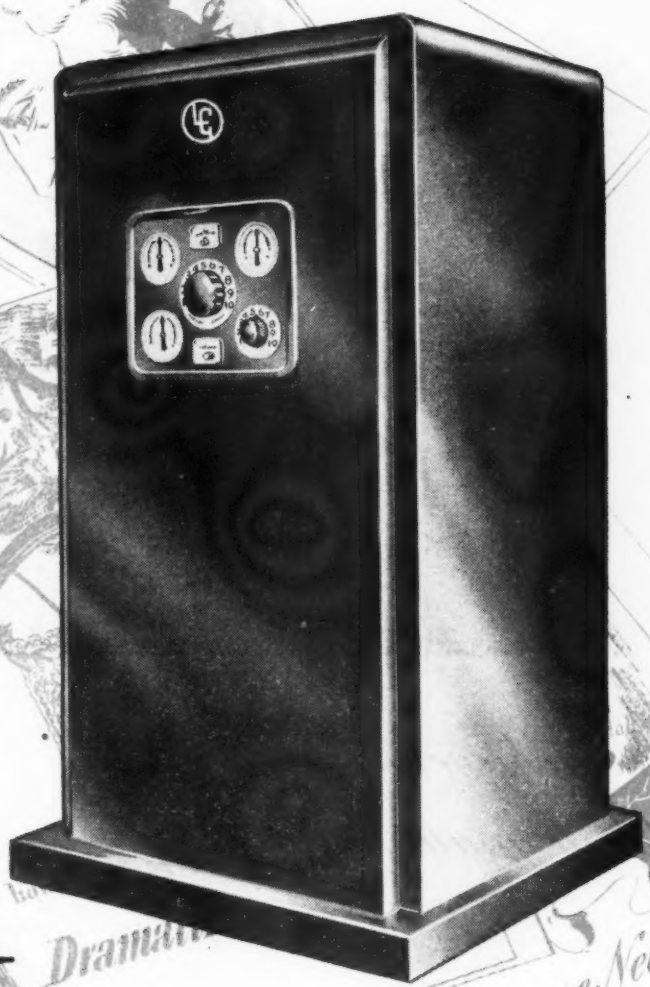
It was during President McKinley's second term, just after the turn of the century, when the first Lombard Water Wheel Governor went into operation at the Woronoco, Mass., plant of the Strathmore Paper Company. To use Strathmore's own words, "It performed faithfully for over forty years" until it was replaced by a new Lombard governor last year. Two other units at Woronoco and two governors at West Springfield, Mass., were also supplied by Lombard.

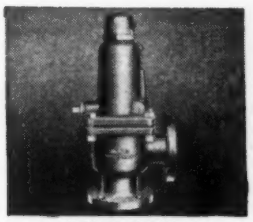
Service records like these are synonymous with the famous name of Lombard. Today millions of horsepower of water wheels all over the world are controlled by Lombard Water Wheel Governors. In the bright tomorrow of peace, new automatic models, with new sensitivity performance features will be available, to carry on the Lombard tradition.

Out of this half century of hydraulic control experience has come special pumping and control units to contribute to the nation's war effort. And when victory is won, Water Wheel Governors, Relief Valves, Centrifugal Pumps, and Variable Speed Drives, of Lombard precision manufacture, will again serve America's future as faithfully as in the past.

Write for engineering bulletins. Lombard Governor Corporation, Ashland, Mass. or 60 East 42nd St., New York, N. Y.

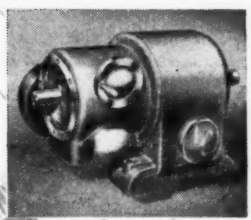
LOMBARD is an Important part of the Paper Picture





RELIEF VALVE

CENTRIFUGAL PUMP



VARIABLE SPEED DRIVE

LOOK TO LG WHEN YOU LOOK TO THE FUTURE

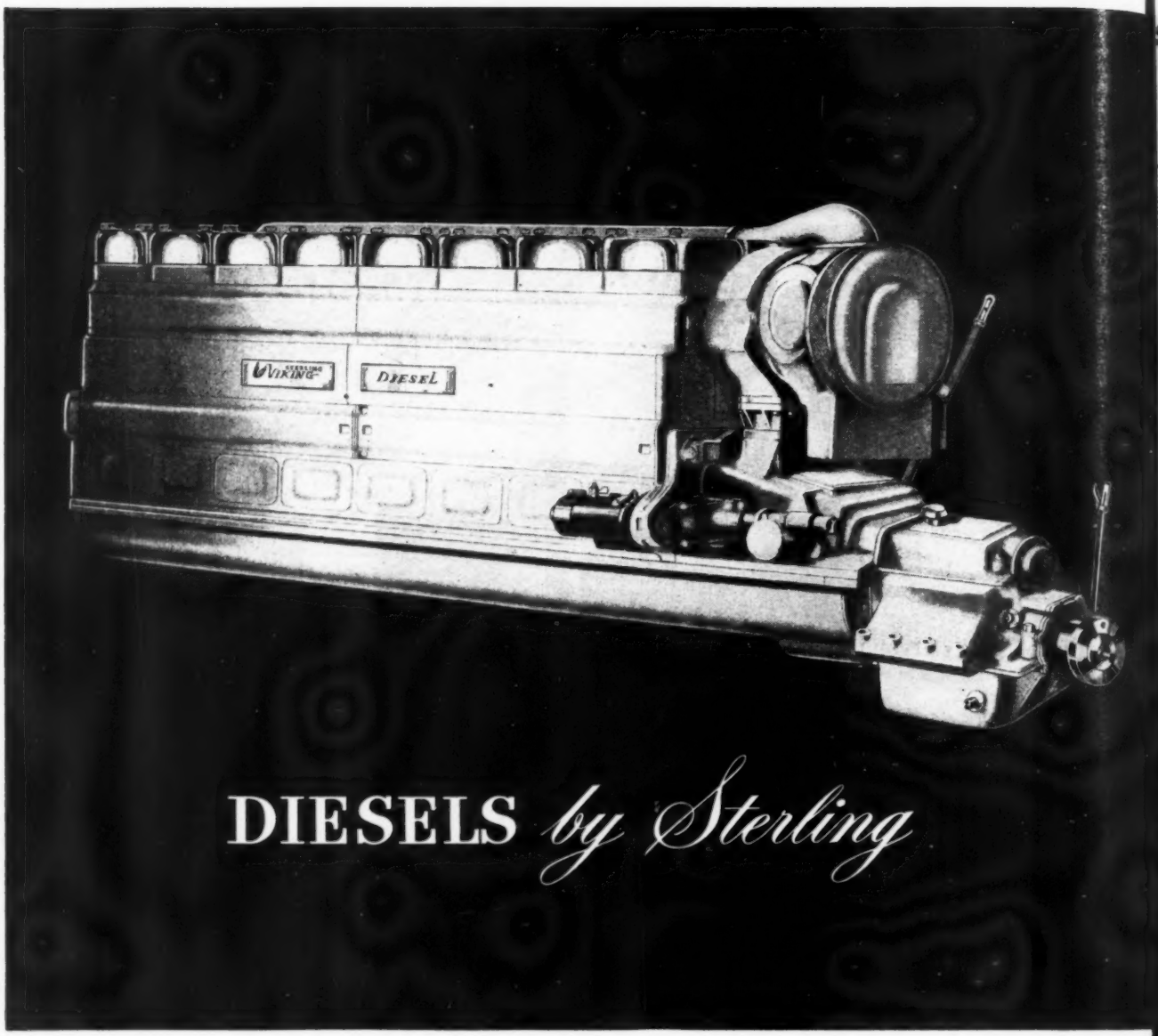
strathmore

ARMY-NAVY E

LOMBARD GOVERNOR CORPORATION

Sales Office · 60 East 42nd Street · New York

ASHLAND · MASSACHUSETTS



DIESELS *by Sterling*

★ *The achievement of 40 years building quality engines for marine and industrial use*

● For many years before Pearl Harbor Sterling engineers were experimenting on a new type diesel engine—a medium duty power plant combining the compactness of a gasoline engine with the efficiency of diesel operation and the economy of diesel fuel.

Now ready for delivery is their achievement—the new Sterling Viking diesel. Here is a compact medium duty power plant rugged enough to give heavy duty performance—yet it operates on two-thirds or less the amount of fuel consumed by a gasoline model of similar rating.

If you are replacing your present power plant or laying plans now for present or future needs, Sterling engineers will be glad to cooperate in furnishing full information for installing the new Viking diesel. Write us for details.

STERLING ENGINE COMPANY
1271 Niagara Street, Buffalo 13, N. Y.
OFFICES IN NEW YORK, WASHINGTON AND CHICAGO

Sterling engines... diesel, gasoline or gas—in marine and stationary models... are now available in horsepowers from 85 to 1200.

SPECIFICATIONS . . . STERLING VIKING DIESEL

Supercharged and Unsupercharged—6 and 8 cylinder

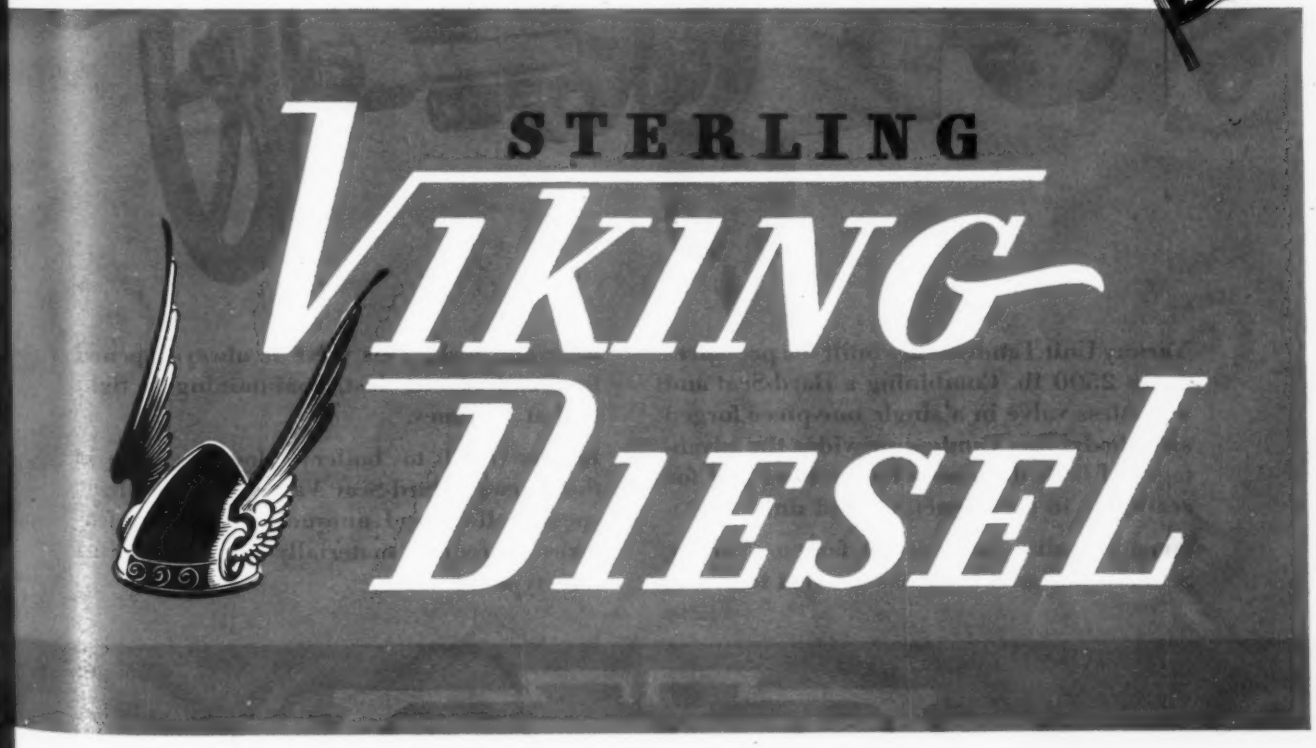
HORSEPOWER RATINGS AND WEIGHT

	6 CYLINDER *Unsupercharged*	6 CYLINDER *Supercharged*	8 CYLINDER *Unsupercharged*	8 CYLINDER *Supercharged*
CONTINUOUS	275 HP @ 1000 RPM	410 HP @ 1000 RPM	365 HP @ 1000 RPM	550 HP @ 1000 RPM
INTERMITTENT	325 HP @ 1200 RPM	495 HP @ 1200 RPM	440 HP @ 1200 RPM	650 HP @ 1200 RPM
WEIGHT WITH REVERSE GEAR	8,000 pounds	8,500 pounds	10,000 pounds	10,500 pounds
WEIGHT WITH REVERSE AND REDUCTION GEAR	10,000 pounds	10,500 pounds	12,000 pounds	12,500 pounds

ENGINE CONSTRUCTION

Cylinder Block: Cast iron enbloc construction. Removable cylinder liners. *Crankshaft:* Counterbalanced 6″ main journals and 5″ crankpins. Crankshaft drilled for full pressure lubrication. *Connecting Rods:* Forged steel, rifle drilled for pressure lubrication to piston pin. *Camshaft:* Located in cylinder block. Removable from side of engine. *Bearings:* Main bearings, connecting rod bearings and camshaft bearings are precision type steel backed. *Pistons:* Cast aluminum alloy, provided with six rings and full floating piston pin. *Valve Mechanism:* Dual intake and exhaust valves actuated by hydraulic lifters through push rods and rocker arms. *Timing Gears:* Helical gears located at forward end of engine. *Reverse Gear:* Bevel planetary type, manual or remote control. Thrust bearing located in after end of reverse gear housing. *Lubrication:* Pressure lubrication to all moving parts. Dry sump. Separate gear driven positive displacement pressure and scavenge pumps. *Cooling System:* Fresh water cooling. Separate gear driven self-priming centrifugal fresh water and sea water pumps. *Fuel Injection System:* Individual cam operated pumps. Nozzles located in center of cylinder heads. Fuel transfer pump gear driven positive displacement. *Supercharger:* Exhaust driven, located at after end of engine. Water-jacketed exhaust manifold. *Governor:* Hydraulic variable speed. Provision is made for remote control. *Starting System:* Two electric starting motors. Gear driven generator for battery charging. *Tachometer and Revolution Counter:* Gear driven electric tachometer and mechanical revolution counter.

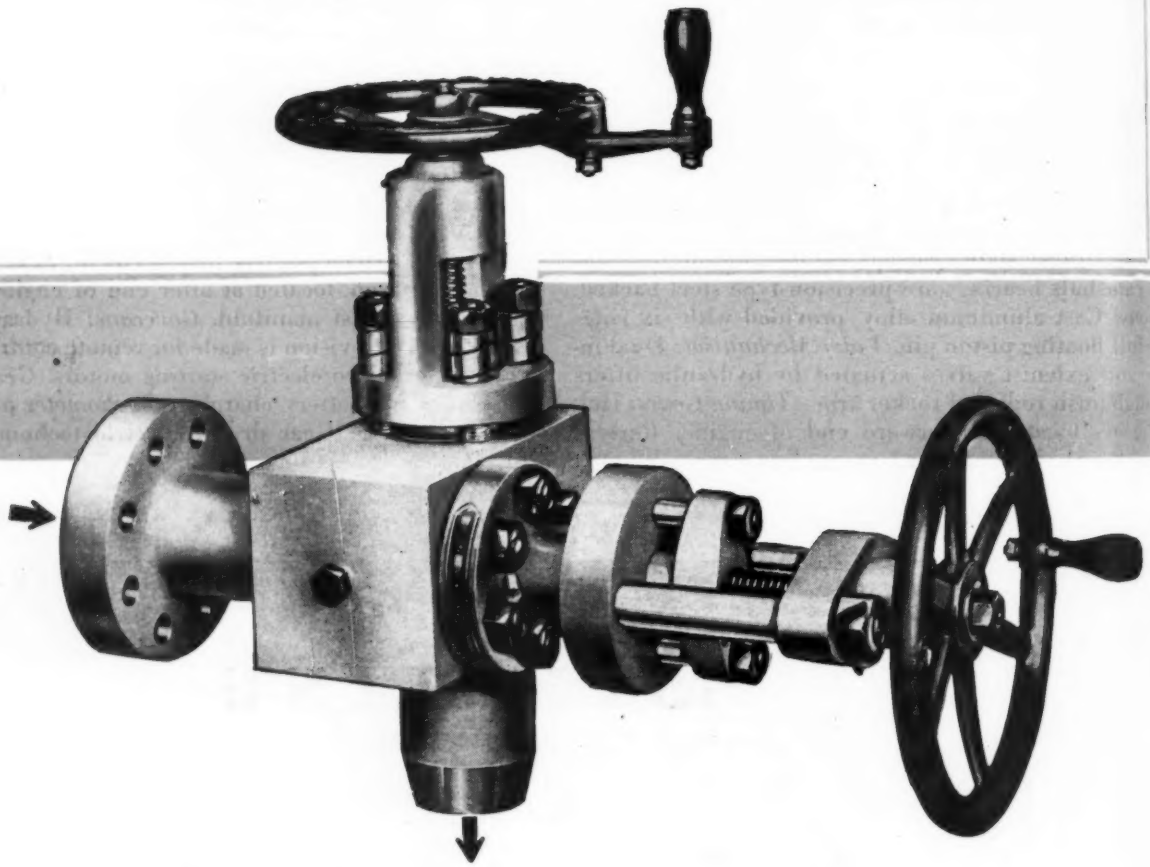
"KEEP BUYING WAR BONDS"



THE UNIT TANDEM

•

Yarway's Finest Blow-Off Valve for the Highest Pressure Service

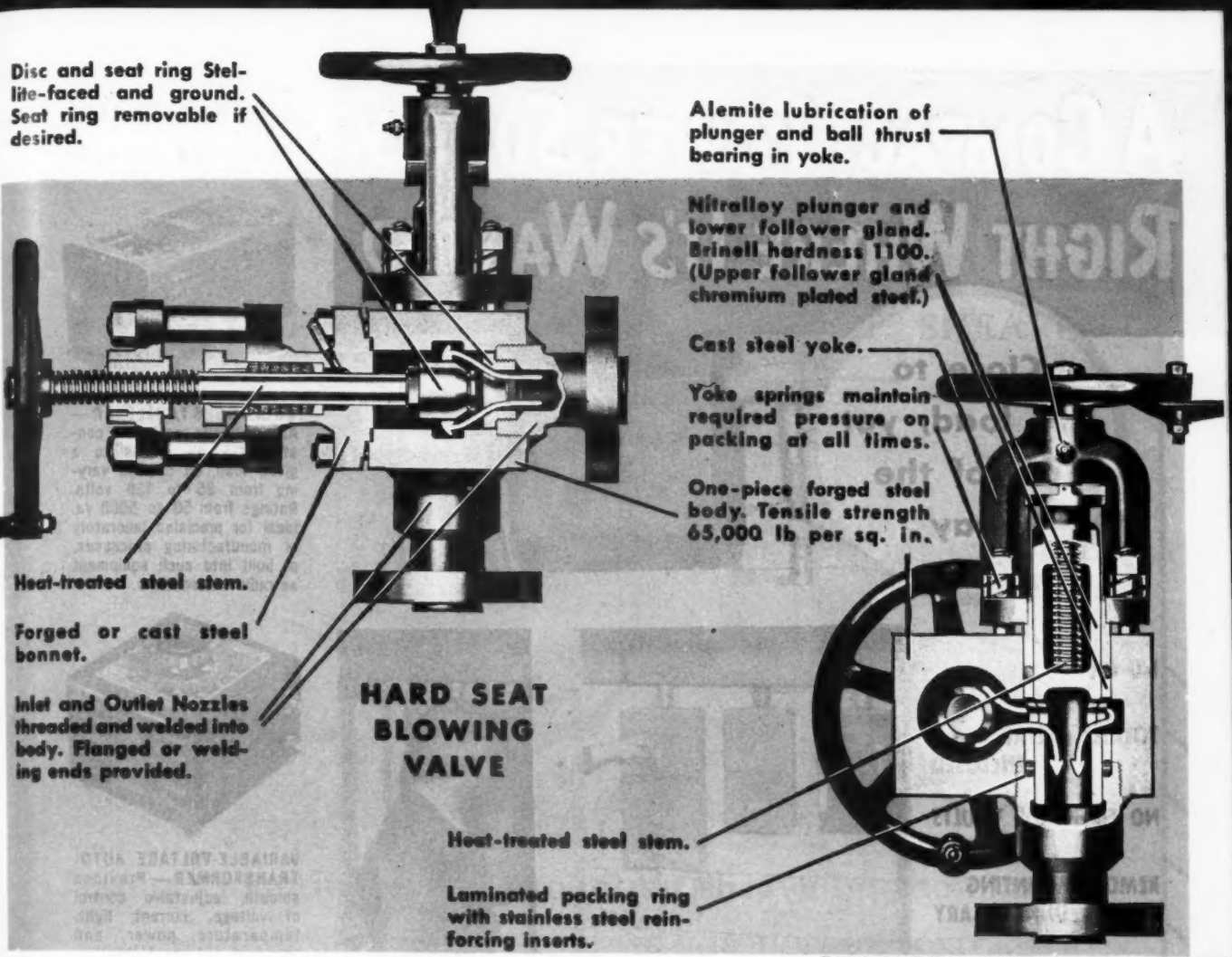


Yarway Unit Tandems are built for pressures up to 2500 lb. Combining a Hard-Seat and a Seatless valve in a single one-piece forged steel body, this Tandem provides the advantages of both designs — for blowing and for sealing — in a compact, rugged unit.

Outside sealing valve is the famous Yarway Seatless design which has no seat to score, wear and leak. This valve is always opened first and closed last, maintaining a tight seal at all times.

Inside (next to boiler) blowing valve is the Yarway Hard-Seat Valve which utilizes special alloys and unique construction features to reduce materially normal wear in this type of valve.

YARWAY


Disc and seat ring Stellite-faced and ground. Seat ring removable if desired.
Heat-treated steel stem.
Forged or cast steel bonnet.
Inlet and Outlet Nozzles threaded and welded into body. Flanged or welding ends provided.
HARD SEAT BLOWING VALVE
Alemite lubrication of plunger and ball thrust bearing in yoke.
Nitralloy plunger and lower follower gland. Brinell hardness 1100. (Upper follower gland chromium plated steel.)
Cast steel yoke.
Yoke springs maintain required pressure on packing at all times.
One-piece forged steel body. Tensile strength 65,000 lb per sq. in.
Heat-treated steel stem.
Laminated packing ring with stainless steel reinforcing inserts.
SEATLESS SEALING VALVE

A Quarter Century of Product Development

Years of service in the high pressure plants of leading Utilities and Industrials have proved the soundness of design and metallurgy of the Yarway Unit Tandem.

Such records as—"3000 blows at more than 1300 lb pressure, without replacement of a single part or repairs of any nature"—have made this Tandem the outstanding preference for high pressure service, today.

Good boiler engineering demands equally sound engineering in the accessories that become part of it. It is not only protection for your investment, but cheap insurance against trouble and expense. The reason why most people specify Yarway Blow-Off Valves.

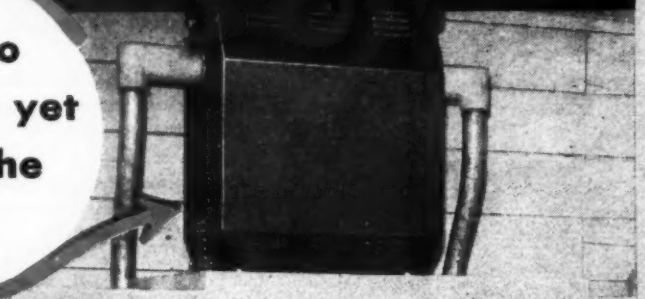
What are your draining or blow-down requirements? Write for Catalog. Section B-431 for pressures up to 2500 lb; Section B-424 for lower pressures.

YARNALL-WARING COMPANY
100 Mermaid Ave., Phila. 18, Pa.

BLOW-OFF VALVES

A Compact Power Supply Right Where It's Wanted

Close to the load, yet out of the way



- ✓ NO OIL
- ✓ TOTALLY METAL ENCLOSED
- ✓ NO FIREPROOF VAULTS
- ✓ REMOTE MOUNTING UNNECESSARY
- ✓ NO LONG RUNS OF HEAVY COPPER

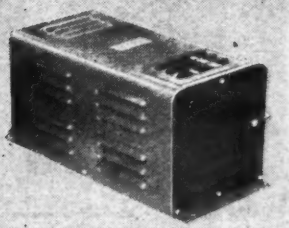
TUCKED AWAY UNDER THE EAVES at Kaiser Cargo, Inc., Shipyard No. 4, this 25-kva G-E dry-type transformer takes power from a 440-volt circuit and steps it down to operate 110- or 220-volt electric hand tools and lighting circuits, close by. The inherent safety that permitted it to be placed close to the load eliminated the need of long runs of heavy, expensive copper.

Installed right at the load, Type D transformers provide your equipment with the right voltage for its most economical operation. They are being used, profitably, from coast-to-coast in industrial plants to insulate one circuit from another and to boost or step down voltage for the most efficient operation of such equipment as motors, machine tools, welding apparatus, heat-treating furnaces, and high-current testing devices.

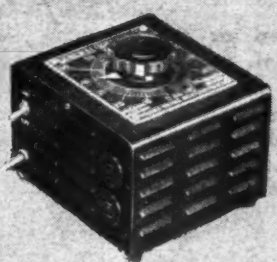
Stay cool; save space—Type D transformers are cooled by natural-draft ventilation. Their unique, drip-proof case, which incorporates a slanted-louver construction, aids the flow of ventilation air through the transformer coils. They can be placed against a wall or close to other units, with little or no effect on the temperature rise of the transformer. Because of this fact, considerable space can often be saved, especially when a number of these transformers are to be banked.

Easy to install; maintenance negligible—As these transformers are small, compact, and lightweight, they are easy to install on the floor, on the wall, or anywhere you wish. Either conduit or open wiring can be used. The ease of disassembly and reassembly of case parts permits quick inspection and cleaning, when necessary. But operating records show that little or no maintenance is required. Type D transformers are available in ratings up to 100 kva, 600 volts. For further information, ask for Bulletin GEA-897. *General Electric Company, Schenectady 5, N. Y.*

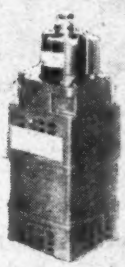
OTHER G-E AIDS TO BETTER VOLTAGE



VOLTAGE STABILIZER—Automatically provides a constant 115-volt supply to a given load, on circuits varying from 95 to 130 volts. Ratings from 50 to 5000 va. Ideal for precision laboratory or manufacturing processes, or built into such equipment as radio transmitters.



VARIABLE-VOLTAGE AUTO-TRANSFORMER—Provides smooth, adjustable control of voltage, current, light, temperature, power, and speed at a turn of the dial. Ratings from 243 to 810 va. Ideal for use in factories, laboratories, and assembled with other equipment.



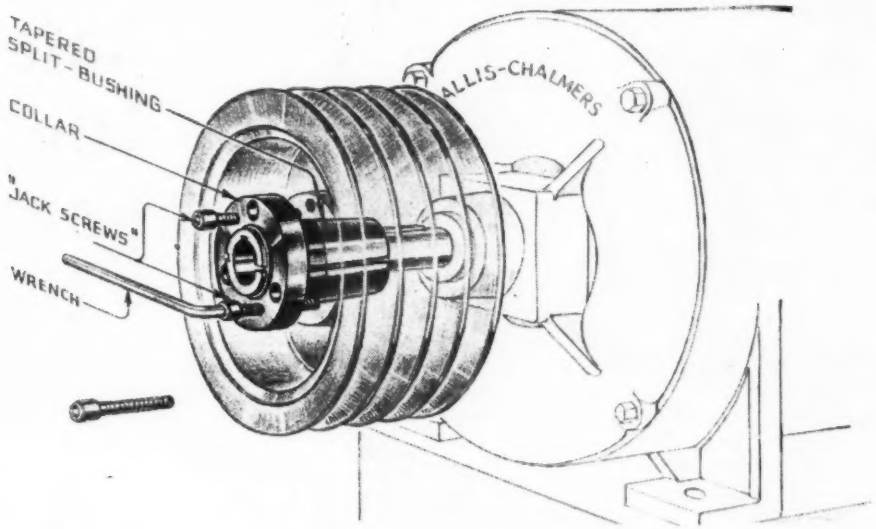
AIR-COOLED REGULATORS—Automatic type: for secondary circuits (10% regulation, raise and lower). Remote-motor or hand operated: for laboratory or testing (100% raise and lower). Ratings up to 12 kva, 600 volts.

THE RIGHT VOLTAGE AT THE RIGHT PLACE DOES THE JOB BETTER

GENERAL ELECTRIC

X-Ray View

OF ALLIS-CHALMERS' NEW "MAGIC-GRIP" SHEAVE



Fastest mounting and demounting sheave on the market, the new "Magic-Grip" costs you nothing extra.

1 **Remove three capscrews** from bushing collar. A handy wrench—supplied with each sheave—is the only tool needed to remove Allis-Chalmers' new "Magic-Grip" from motor or machine shaft quickly and easily.

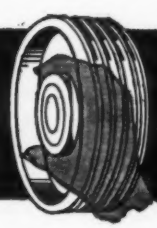
2 **Insert two capscrews** in tapped holes. As screws are turned, they become levers . . . automatically breaking tight grip of tapered split bushing on sheave and shaft. Entire unit is then ready for removal.

3 **Remove sheave from shaft.** Requires no mallet, no prying, no bulging muscles. You just slide the sheave off . . . smoothly, quickly. *It costs nothing extra!* Send for B6310. Allis-Chalmers, Milwaukee 1, Wis.

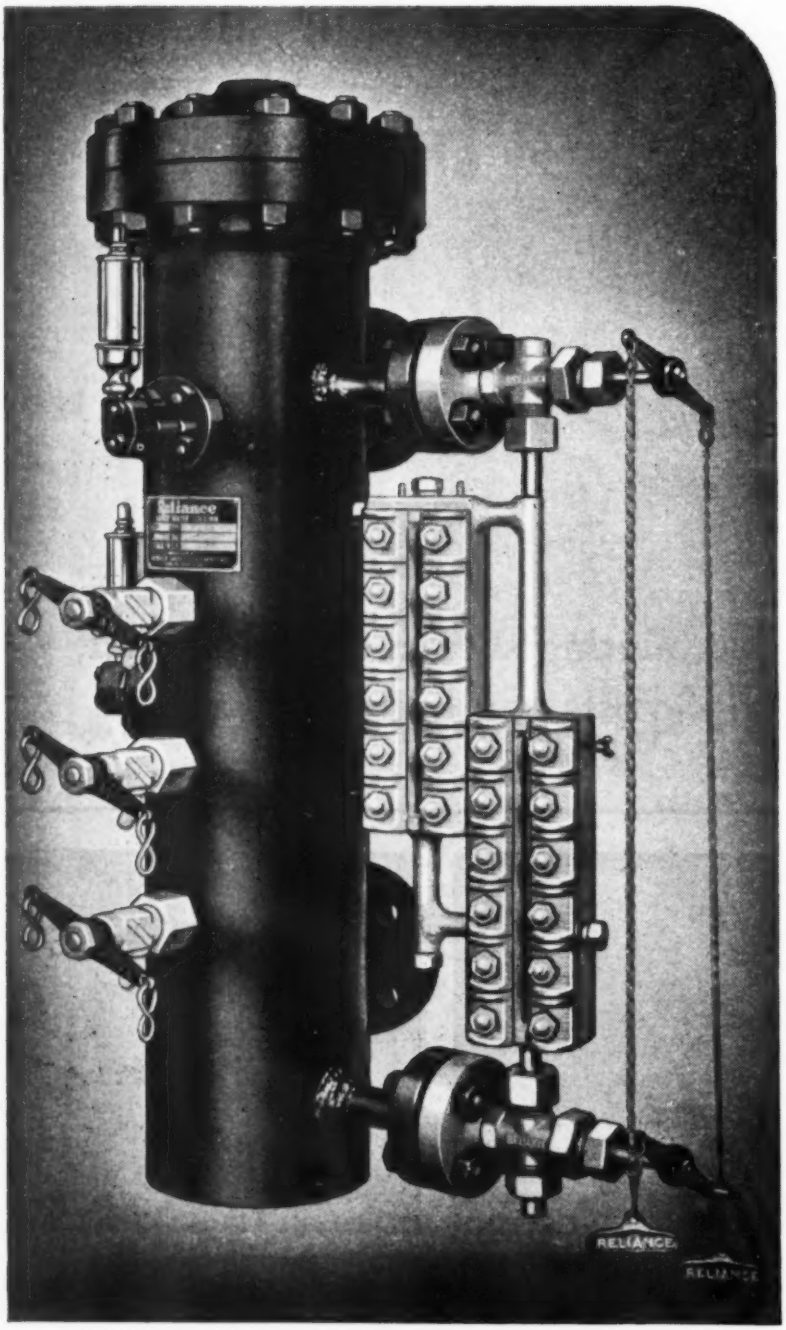
A 1770

Allis-Chalmers Texrope

"MAGIC-GRIP" SHEAVES



Boiler Water Level



★ Reliability
★ Safety
★ Long Life
★ Reasonable first cost
★ Low Upkee

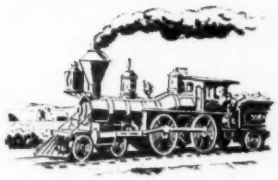
THERE are over 50 designs and variations in the Reliance line of ALARM Water Columns and water columns without alarms. Those having alarms are equipped with sensitive, positive float-operated alarm mechanisms that have been refined and proved during the sixty years since Reliance introduced the first water columns so equipped.

60 Years of Boiler Protection

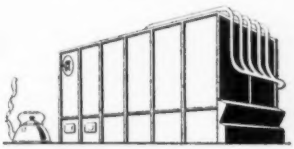
1884-1944 Reliance

Security Pays Dividends

. . . that's why Reliance Boiler Safety Equipment ranks high as a profitable investment for your future power plant

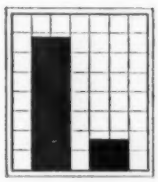


Reliance is the pioneer maker of boiler safety devices—was the first to make the ALARM safety water column available to power plants, in 1884.



Reliance builds equipment for the largest steam generating units and the smallest heating boilers.

Reliance builds for all pressures—the highest yet produced in commercial power plants, and vessels operating at no pressure at all.



Reliance builds the bulk of water columns and safety boiler gages used in America—is the only manufacturer whose facilities are devoted entirely to this type of equipment.

Reliance equipment is approved by national and state code authorities, boiler makers, government bureaus, consulting engineers and operating engineers everywhere.

BOILER SAFETY DEVICES

THE RELIANCE GAUGE COLUMN CO.
5902 Carnegie Ave., Cleveland 3, Ohio

Every Belt a Specialist

In Allis-Chalmers' Great New V-Belt Line!

When Allis-Chalmers recommends a certain belt for a certain job, you can be sure it's the *right* belt. Because: 1) the Texrope line is *complete;* 2) Allis-Chalmers invented the multiple V-belt drive, offers engineering advice based on unparalleled experience. Both sound reasons for making Allis-Chalmers your "V-Belt Drive Headquarters."

1

HEAT-RESISTING SUPER-7, made of Buna-S synthetic rubber, has ability to withstand heat built right into it. Standard Super-7 belt, it can successfully operate in ambient temperatures up to 180 degrees F.

2

OIL-RESISTING SUPER-7 specializes in operating under fairly bad oil conditions. Neoprene, a synthetic impervious to oil, grease, other grimy liquids, is the cover for the regular Buna-S Texrope V-belt core.

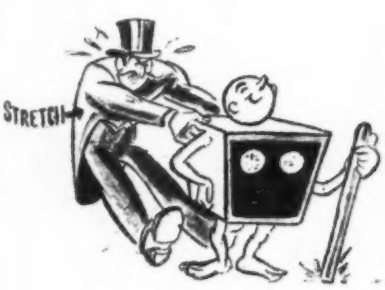
3

OIL-PROOF SUPER-7 is made of solid Neoprene, which is unaffected by most rubber-attacking liquids. It is recommended for drive installations where V-belts are virtually swimming in oil or grease.

4

STATIC-RESISTING SUPER-7 conducts static charge to machine to ground it. Static conducting element is contained throughout belt cover — can't wear off. This belt is used where explosion danger is present.

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*



5

SUPER-7-STEEL employs endless cables of steel to reduce belt-stretch, provide greater horsepower. It is used where V-belt drive centers are hard to adjust, loads to be driven are extra heavy, space is limited.

A-1731

It pays to make

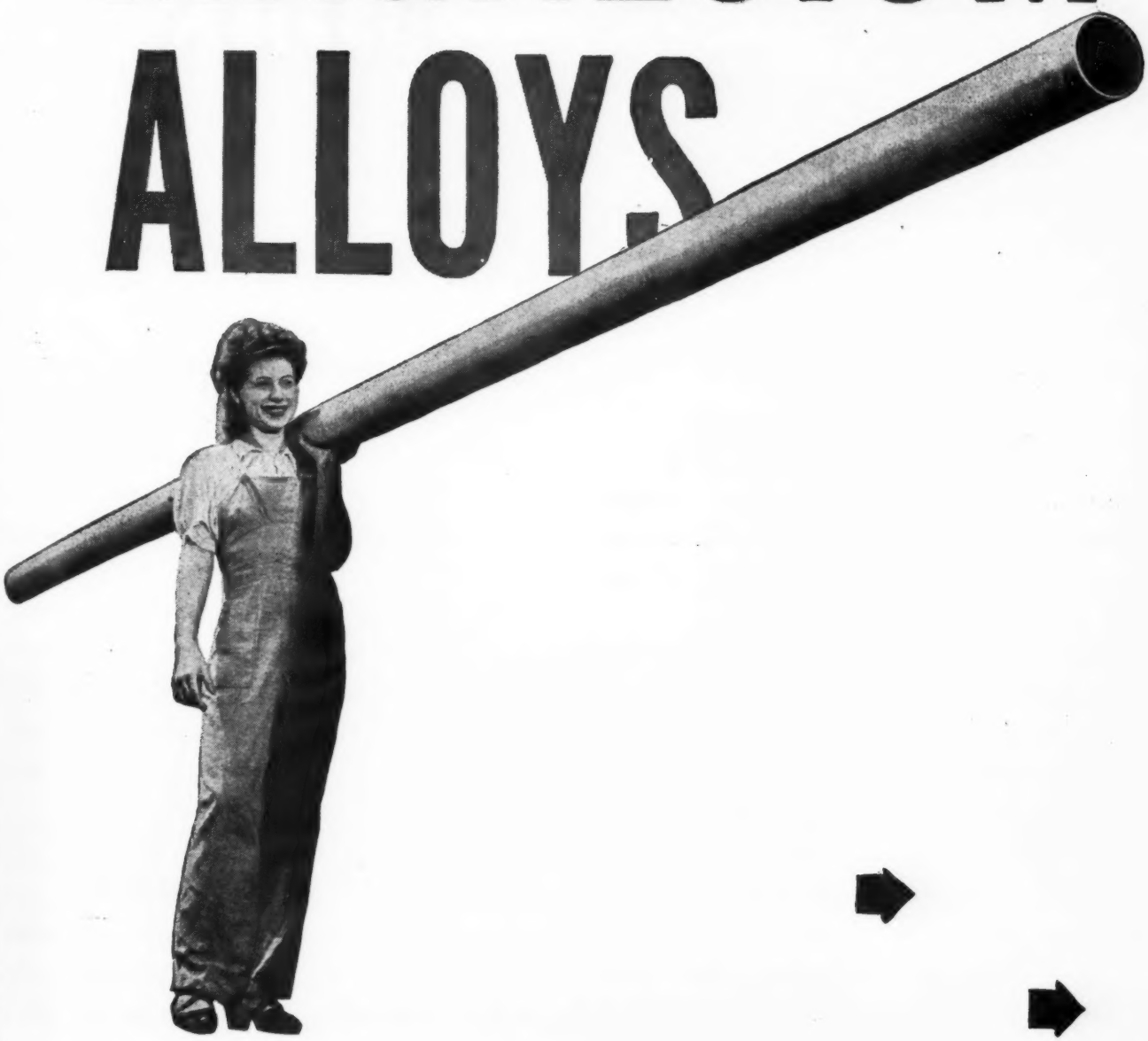
ALLIS-CHALMERS

your

V-BELT DRIVE HEADQUARTERS

Texrope Super-7 V-Belts result from the cooperative research of two great companies—Allis-Chalmers and B. F. Goodrich—and are sold exclusively by A-C.

REVERE MAGNESIUM ALLOYS



Lightening the burden of weight on men and machines . . .

REVERE MAGNESIUM ALLOYS

EVERY pound of Magnesium Alloy substituted for other metals will save weight. In the case of steel, the saving with equal thickness is 77% and with Aluminum Alloy it is 37%.

Magnesium wing tips, floor beams, oil and fuel tanks, seats, engine parts, wheels, housings, fairings, panels and many other parts have effected tremendous savings in the weight of modern aircraft. The result is greatly increased capacity in speed, range and payload.

War's spectacular uses introduce the new age of magnesium to American Industry

Mass in motion requires power—to start, to maintain, to stop. Power is expensive whether it is steam, electricity, gasoline or man's muscles. Magnesium alloy pattern plates in a foundry, are reported to have reduced one man's lifting by 4500 pounds a day.

Consider the Weight-Power Ratio

Power varies directly with mass or weight. Disregarding friction, a magnesium unit requires less than one-fourth as much energy to overcome inertia as a steel unit of the same dimensions.

The favorable weight-strength and weight-stiffness ratios mean that very little, and sometimes none of this power saving need be sacrificed when magnesium alloys are substituted.

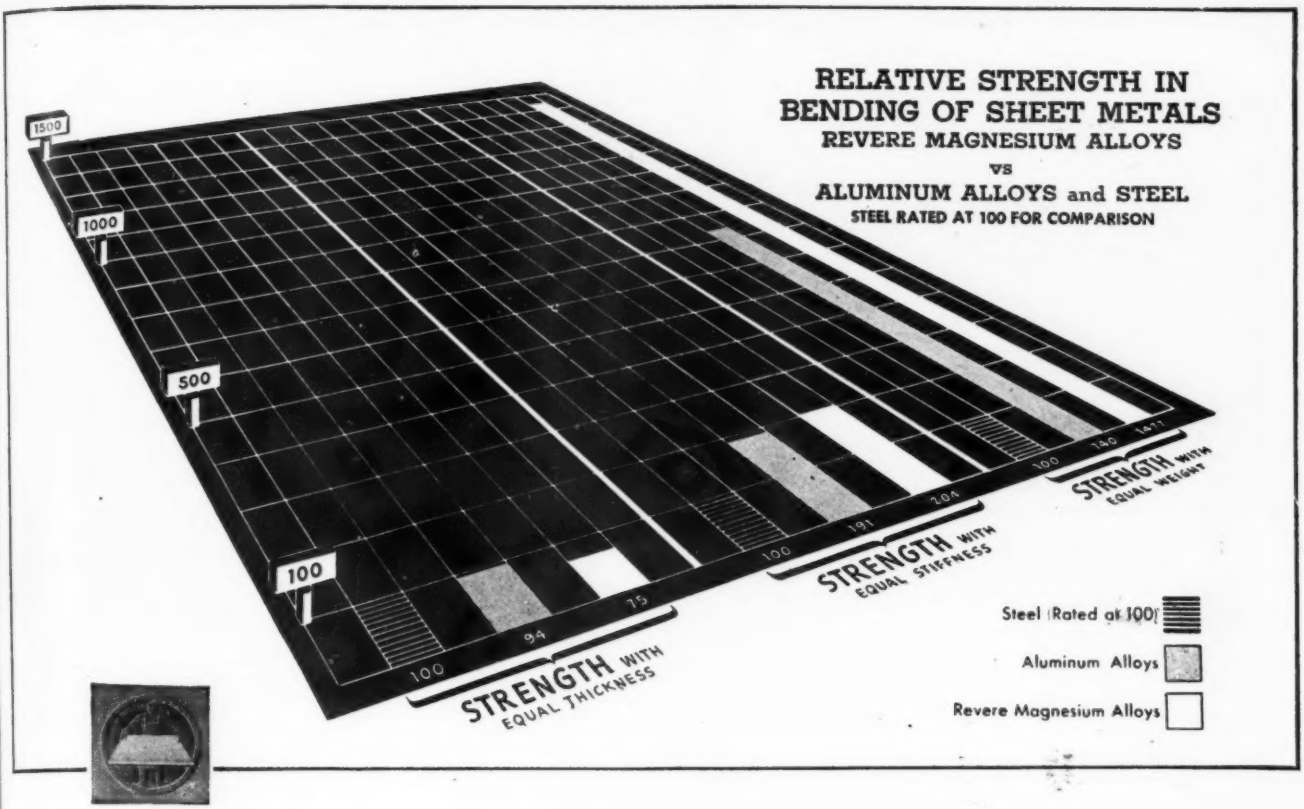
A pound of magnesium contains about 15½ cubic inches—a pound of steel 3½ and aluminum 10 cubic inches. On a pound for pound basis, you get 4½ magnesium units for one of steel and 1½ to one for aluminum. Magnesium goes further, and the further it goes the more you save. Remember that weight-saving means money-saving from the very beginning, in transportation and handling to and within your factory, in production processes, and in the end use of the product.

Lightness plus strength

Revere Magnesium Alloys offer strength as well as weight saving. With equal thickness, the sheet alloys have 75% of steel's strength in bending. To gain equal strength, the thickness need be increased only 15%, since strength in bending increases as the square of the thickness. To gain equal stiffness, an increase of only 65% in thickness is needed, since stiffness in bending increases as the cube of the thickness. With equal stiffness, the strength is double that of steel. With equal weight, bending strength is over 14 times that of steel. See the Chart.

Where to save with Magnesium

Transportation. Railroad cars, buses, trucks, trailers, aircraft. Will make it possible to haul heavier payloads in states limiting total weight on the road.



Hand-Operated Items. Anything pushed, pulled, lifted, carried. Vacuum cleaners and other household appliances; baby carriages; hand and portable tools; typewriters; instrument cases; luggage; hand trucks and dollies; mailing containers.

Reciprocating Parts. Anything that must be started, stopped, reversed in motion. Light weight and rigidity save power, reduce vibration.

Mill Products Available

Revere magnesium facilities are among the largest in the world. They offer sheet and plate, rod and bar, tube, extruded shapes, forgings and forging stock, in four different alloys.

May We Assist You?

The Revere Technical Advisory Service is at your command, ready to help you take full advantage of the remarkable qualities of Revere Magnesium Alloys. Let us show you how to use them to modernize and improve your own product, how production can be speeded up by increasing machining speeds, how to form, weld and rivet, simply, economically.

Write for your complimentary copy of the *new* 32-page booklet, "Revere Magnesium Alloys and the Light Metals Era," now coming off the presses. Presents the basic facts about magnesium, plus detailed technical data on the physical, mechanical and working characteristics of the Revere Alloys.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

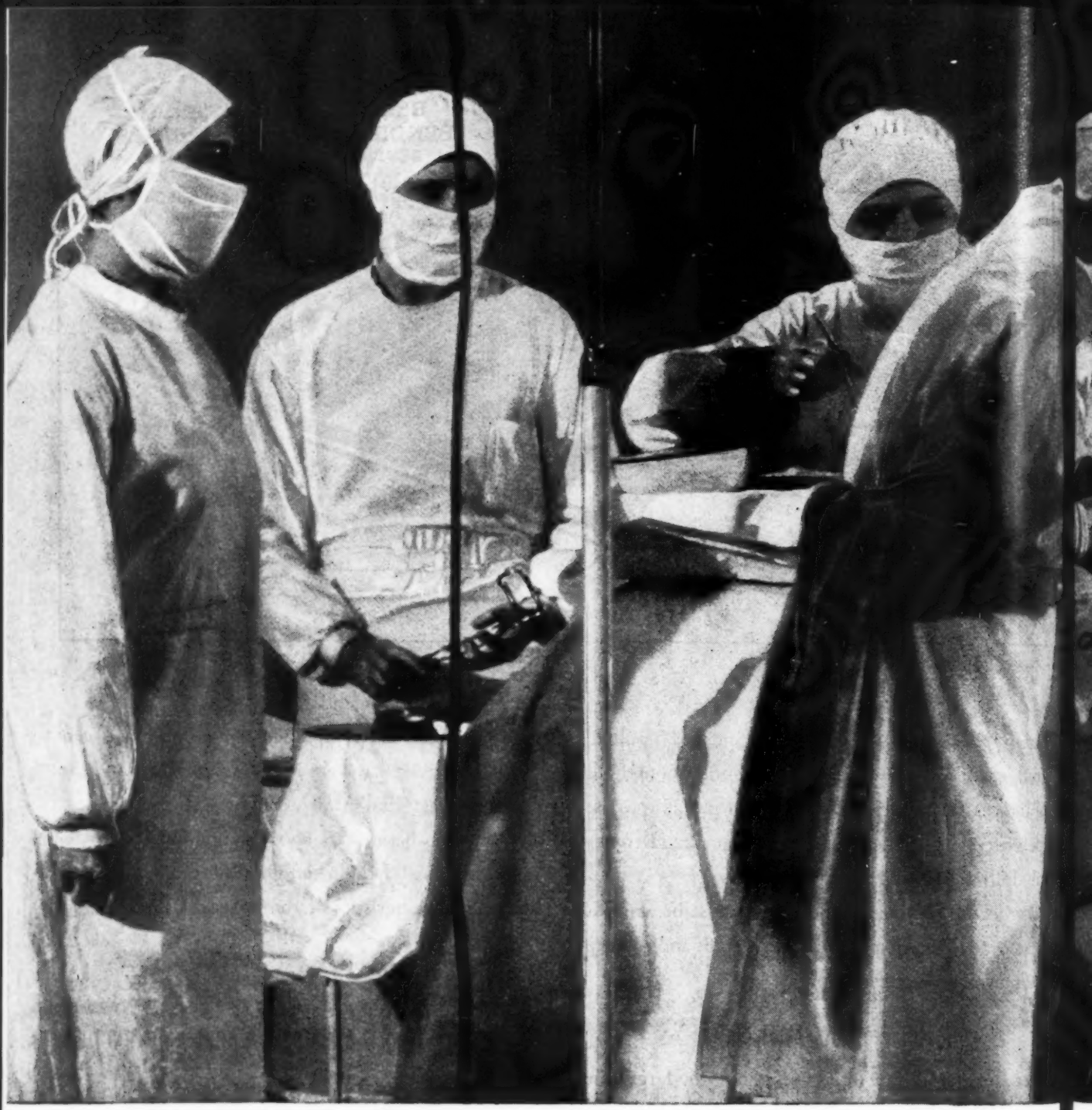
MAGNESIUM-ALUMINUM DIVISION

Executive Offices: 230 Park Avenue, New York 17, N.Y.

Availability

Magnesium facilities were developed to help win the war. Now the supply is adequate and many applications other than in aircraft are being approved.

If your products can be improved by the use of Revere Magnesium alloys, we suggest you consult us about availability for civilian products.

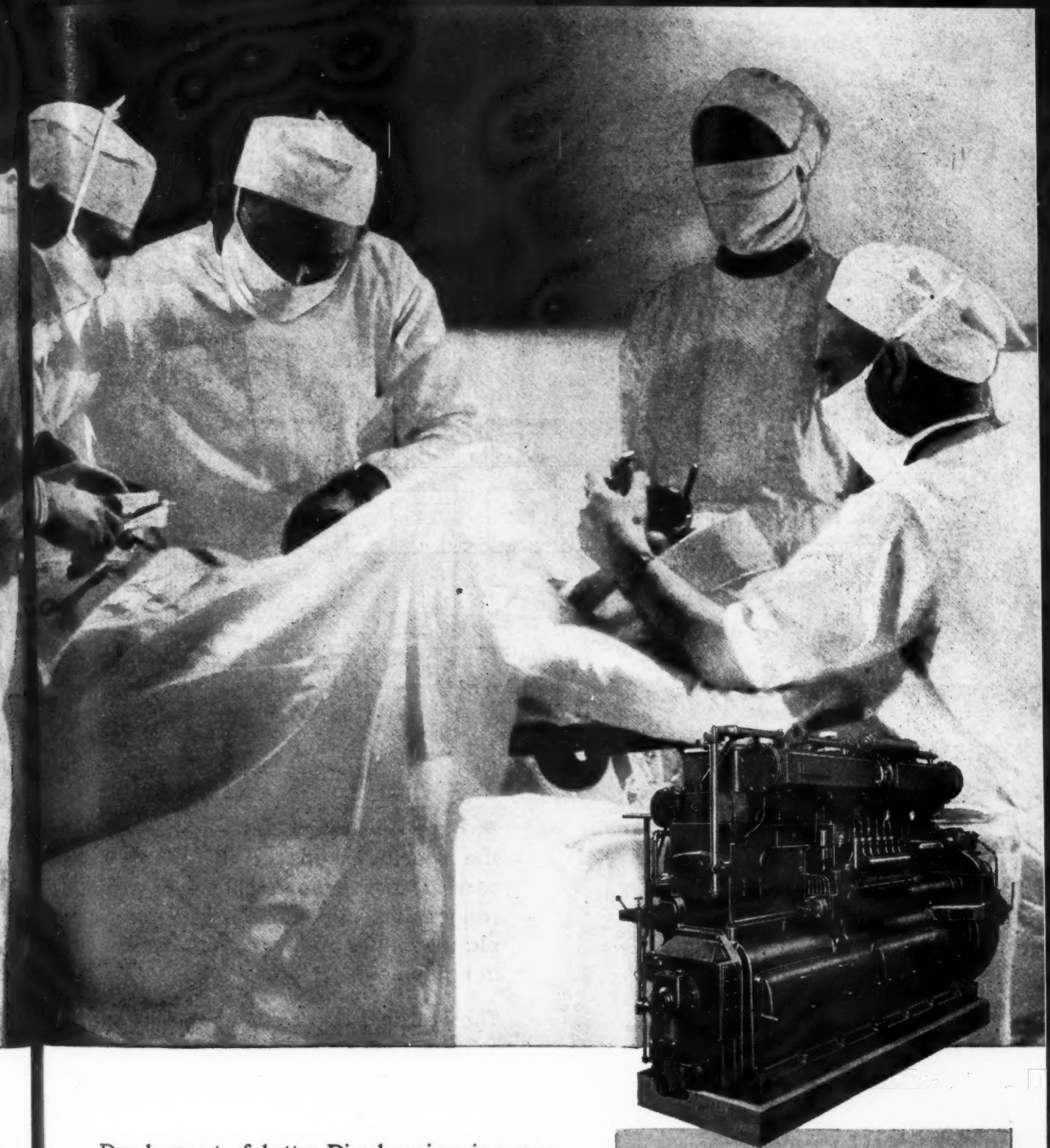


QUICK POWER FOR EMERGENCIES!

This hospital installed two ALCO Diesel Engines because it wanted quick power ... dependable power ... and a compact economy of power plant space!

There are places and purposes where quick, dependable, continuous power is desperately needed. Instant power, from units requiring minimum space. That is one reason why more than 1,500,000 horsepower of ALCO Diesel Engines have been installed!

This extraordinary record was made possible by ALCO's engineering organization, highly specialized manpower, finely tooled shops ... and the enormous advantage of the Diesel engine proving ground provided by ALCO's vast railroad activities.



Development of better Diesel engines is a continuous process with ALCO. ALCO pioneered the light-weight, high-speed, heavy-duty Diesel engine of greater dependability.

Every Diesel engine ALCO can produce today is needed for war service. But research goes on... and when war ends, you will hear of further ALCO improvements... refinements of engine design that mean better Diesel engine values than have ever before been available for your power plant needs.

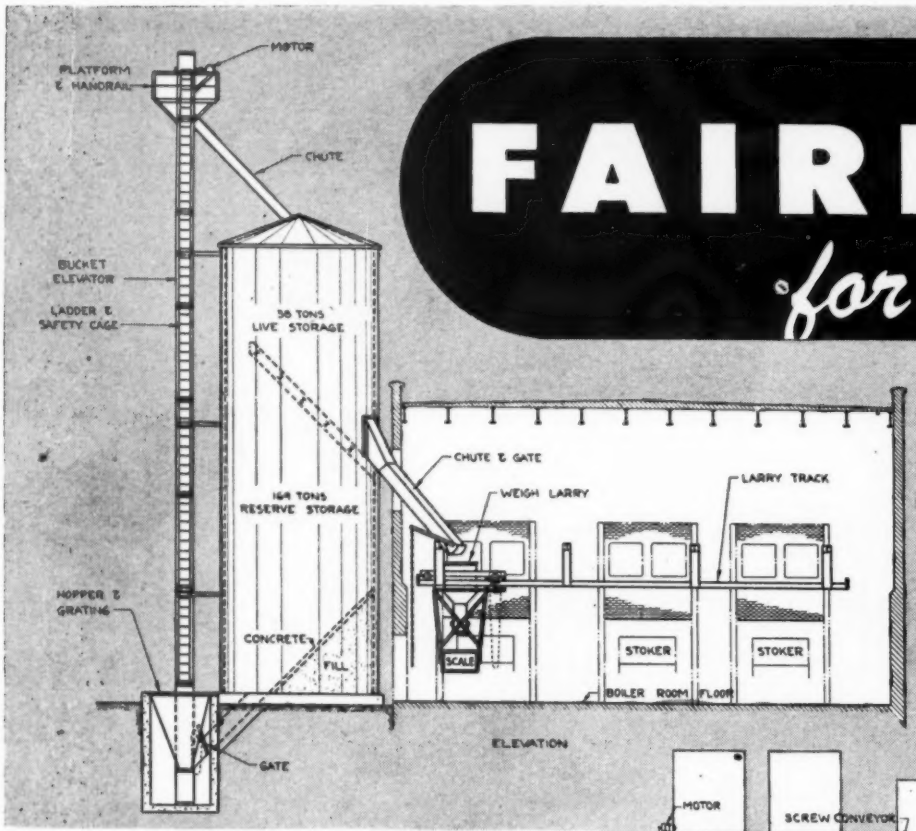
American Locomotive

ALCO DIESEL ENGINES

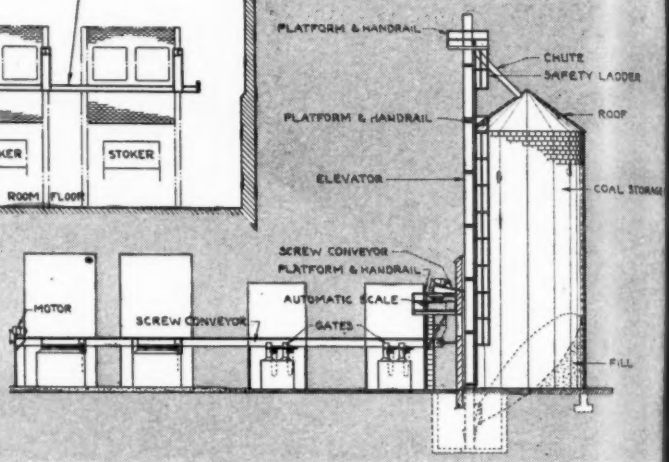
For Universal Application

30 Church Street, New York 8, N. Y.

PICK TH
FAIRFIELD
for Coal and



At left—diagram Silo system wit weigh larry. Below—diagram o system with screw conveyor fo coal distribution.



• Fairfield Systems are engineered to mee the specific needs of the plant which i serves. You have a choice of various ar rangements depending upon your present plant facilities and what you expect to invest in equipment.

The Fairfield Silo System consists mainly of a vitrified tile circular silo — conveyor and hoist mechanism for handling coal from car to silo and screw conveyor or weigh larry for distribution of coal to stokers or pulver izers.

The vitrified tile silo protects coal from mois ture and its circular construction provides maximum capacity with minimum of space. Silos are furnished in 12 to 24 foot diameters in capacities of 100 to 500 tons each.

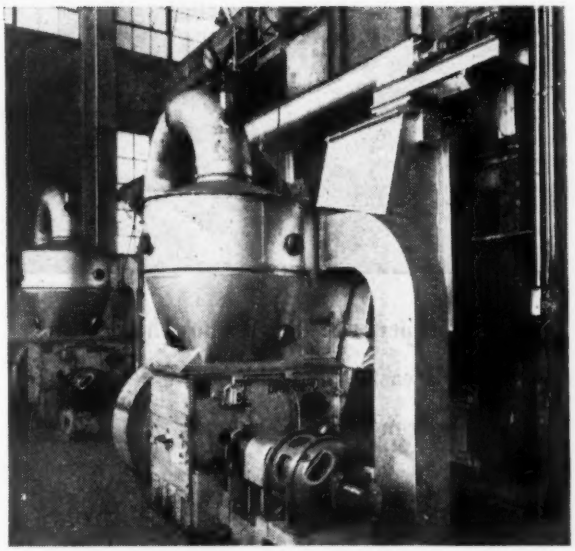
Full descriptive catalog illustrating numerous combinations of handling systems is available on request. For specific information on your plant contact a nearby Fairfield Representative. No obligation.

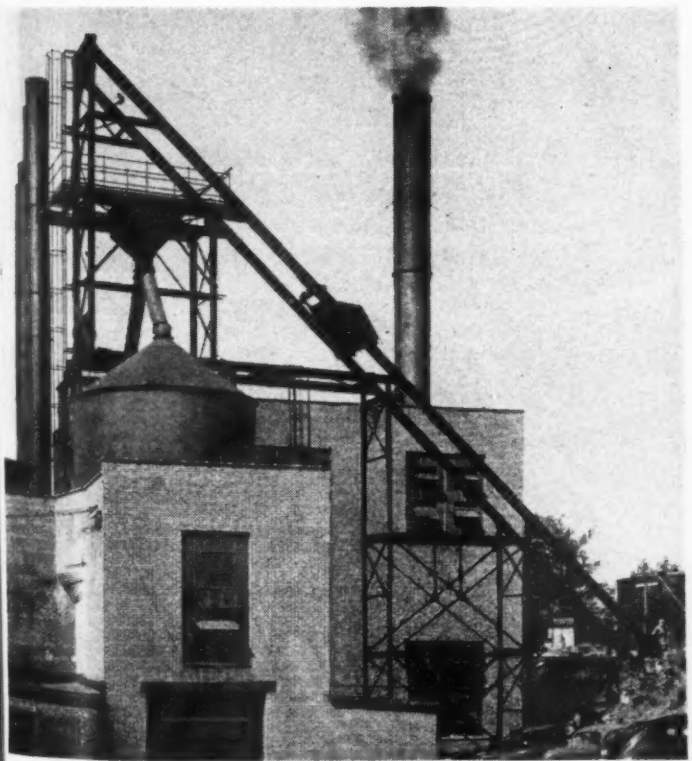
SYSTEM TO FIT YOUR NEEDS

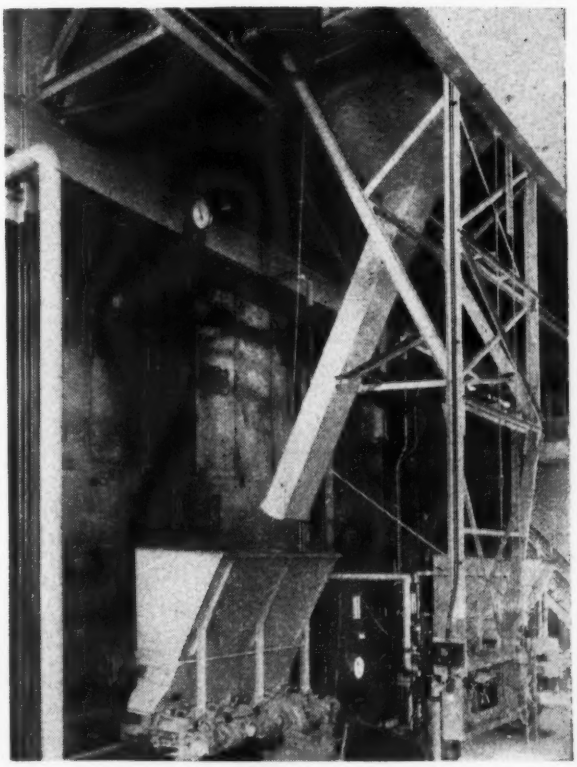
Engineered SYSTEMS

Ash Handling...

- At the right is shown an installation view of a screw conveyor carrying coal from storage to two unit pulverizers. This same system of distribution may be used to feed stokers.
- At the lower right is shown a two ton motor propelled weigh larry for feeding stokers. This method is also used extensively in small plants with a hand propelled larry.
- Directly below—is shown a Skip Hoist handling 50 tons of coal an hour at a prominent paper mill. Skip bucket has 60 cu. ft. capacity and a lift of 102 feet. It delivers coal to two cylindrical steel bunkers each having 100 ton capacity.





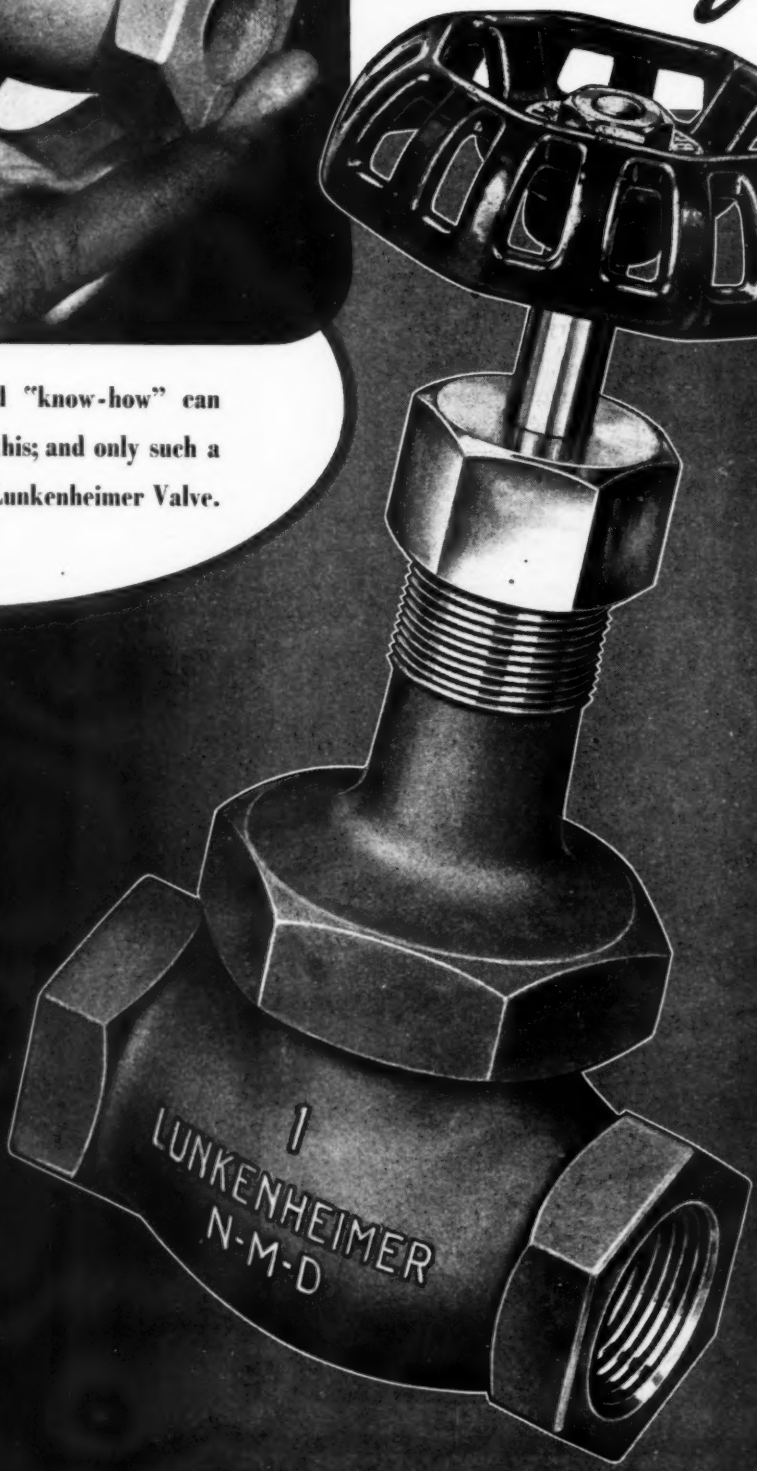


THE FAIRFIELD ENGINEERING CO.- MARION, OHIO

BUILDERS OF COAL AND ASH HANDLING EQUIPMENT

You can see ... in every line

Only experience and "know-how" can make a casting like this; and only such a casting can make a Lunkenheimer Valve.



SIMPLICITY OF DESIGN MEANS EASIER MAINTENANCE

BRONZE, IRON, STEEL AND CORROSION-RESISTANT ALLOY VALVES

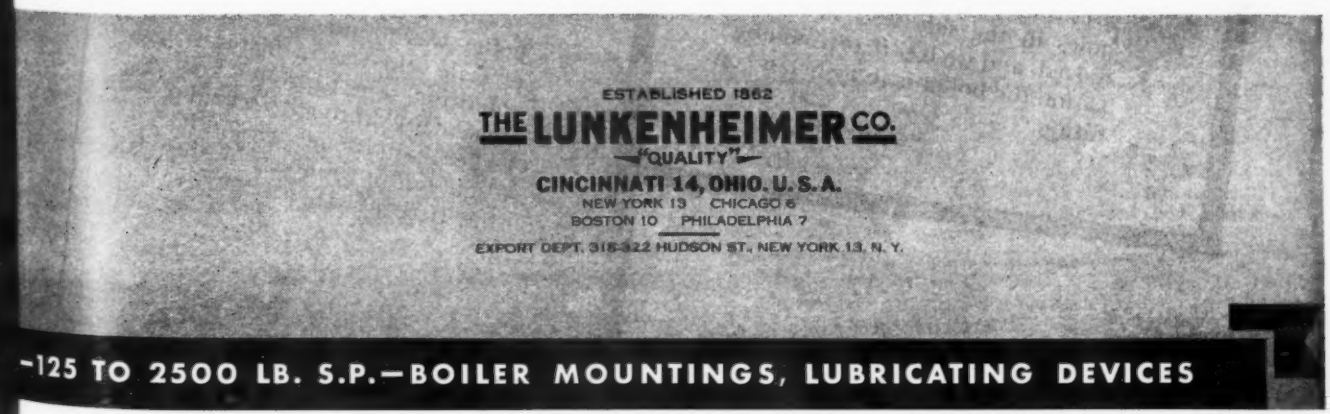
the Quality of a LUNKENHEIMER VALVE

From handwheel to pipe threads a Lunkenheimer Valve reflects exceptional strength and ruggedness. Ample proportions and perfect balance of all parts are basic design features that give assurance of the good service and long life so characteristic of Lunkenheimer Valves.

Maintenance men have long since come to depend upon Lunkenheimer for the best in valve service . . . knowing they will get the highest degree of performance with the least amount of trouble and maintenance expense.

•

Lunkenheimer distributors are located in all industrial centers. Use the complete facilities of the one nearest you for service on your requirements.


ESTABLISHED 1862
THE LUNKENHEIMER CO.
"QUALITY"
CINCINNATI 14, OHIO. U. S. A.
NEW YORK 13 CHICAGO 6
BOSTON 10 PHILADELPHIA 7
EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.
-125 TO 2500 LB. S.P.—BOILER MOUNTINGS, LUBRICATING DEVICES

No. 28-118-42

What power plant operators s

No.1 Six years continuous boiler service

"The two 400-pound pressure boilers at our Camas, Washington plant (a large paper mill) have been on the line for six years, except for the annual holiday shutdowns of 4th of July, Labor Day and Christmas.

"Our Chief Steam Engineer reports that on this last 4th of July shutdown he again examined the boilers and found them in excellent condition, and that he considers that this good operation may, to a very large extent, be attributed to the success of the Hall System of boiler water conditioning."

No.2 Boilers stay in first class condition

"During the summer of 1941 the plant (a large tire and rubber company in Canada) installed a new boiler to operate at higher ratings than the old boilers, and desired to keep this new boiler in continuous operation except for scheduled outages, such as semi-annual inspections, etc." Three months after institution of Hall service the following report was received from the plant engineer: "We now have No. 7 boiler removed from the line after approximately three months' run, and it will be out of service for approximately a week.

"We have the manholes of the drums open as well as several hand holes in the side wall headers removed, and we feel that from observation the boiler is in first-class condition."

No.3 Boiler Tubes Clean as a Whistle

"Boilers (large iron works) cleaned, turbined and inspected on August 1. The boiler was found to be clear of scale and was in first-class condition. The turbining was done mainly through a set rule rather than through need of it. Client said it was like running the turbine through new tubes."

say about Hall Service:

These enthusiastic testimonials from Hall clients are an indication that Hall System of Boiler Water Conditioning is really doing a worthwhile job. Power Plants are staying in service continuously when they are needed most. What's more, some of the manpower and steel formerly needed for maintenance work can be used for other purposes.

The Hall System of "Preventive Care" keeps boilers healthy. A Hall Field Engineer is prepared to help you correct any boiler trouble that may develop. Supporting him are the most complete boiler service laboratories in existence for this need. However, his main job is to help you apply *preventive* aid.

In your own experience you can probably recall dozens of cases of boiler outages which wouldn't have occurred had you done sooner the things you learned too late. There was never a time when a service like this could mean as much to you as it does today. May we tell you about it?

HALL LABORATORIES · HAGAN BUILDING · PITTSBURGH 30, PA.

HAGAN
HALL
BUROMIN
CALGON

HALL SYSTEM
of Boiler Water Conditioning

Hall Service in a Nutshell

At your immediate disposal are placed the technical knowledge and facilities of the pioneering leaders in scientific boiler water conditioning. In addition, with your full cooperation, Hall Service:

1. **Minimizes boiler outages caused by water.**
2. **Helps maintain highest efficiency.**
3. **Establishes non-embrittling water.**
4. **Minimizes carryover.**
5. **Prevents corrosion in boilers and associated equipment.**
6. **Prevents deposition in water lines and cooling systems.**

Ductility

...AND ITS OVERALL IMPORTANCE IN AN ENGINEERING METAL

In general terms, ductility is the property of a metal that permits it to be deformed without fracture.

It is the exact opposite of brittleness.

If two materials have the same strength and hardness, the one with greater ductility has a good chance of holding up under overloads which would snap the other.

Thus, ductility is especially important in bolts, where strain is likely to result from too vigorous tightening or from abrupt temperature changes. It also is an essential property in metal gaskets. A strong, ductile gasket will adapt itself readily to imperfections in joint surfaces while maintaining the strength necessary to prevent leakage.

And, finally, high ductility is a great advantage in fabrication. The more ductile the material, the more easily it can be handled by the usual cold-working methods... bending, deep drawing, spinning, cold heading.

Strength and Ductility

By the very nature of materials, strength and ductility are divergent properties. As one increases the other decreases. As a general rule, highly ductile metals are soft and weak; some high strength metals are hard and comparatively brittle. But one of the outstanding characteristics of INCO Nickel Alloys is their exceptional combination of strength with high ductility.

How Ductility is measured

There are several methods for testing the ductility of metals, but the most common method is to pull a specimen of the metal on a tensile testing machine until it breaks. The ductility of the metal is then determined by measuring how much the specimen "stretched" or elongated.

This is the method which was used in measuring the strength-ductility of Monel and other metals as shown in the charts below.

What the charts show

In Fig. 1, showing tests made by R. L. Templin and R. G. Sturm, the top point of the curve indicates the tensile strength of the various metals. Ductility... as evidenced by the metal's "stretch"... is shown by the horizontal carry of the curve to the point where it drops off sharply.

Fig. 2 shows the results of strength-ductility tests with ⅜" diameter bolts of Monel, brass, bronze and steel, as determined at Columbia University, New York City. This test shows the high value of Monel for bolts and similar applications.

Spun Monel diaphragms

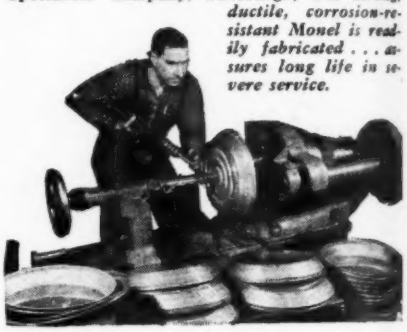
Stronger than mild steel, Monel is ductile enough to be formed in the most severe of all metal working methods... spinning.

Diaphragms for gas meters and gas analysis instruments are spun from Monel, as illustrated in the accompanying photo.

Ductility makes the spinning process easier... the combined strength, hardness and corrosion resistance mean longer life for the finished Monel part.

HIGH-TEMPERATURE HIGH-PRESSURE STEAM *line gaskets formed from Monel by Goetze Gasket & Packing Co. Combined strength-ductility of Monel permits thinner gaskets, saving stress on bolts. Monel gaskets adapt self to joint surfaces... assure strong, tight, lasting seal.*

SPINNING MONEL DIAPHRAGMS *for gas meters and gas analysis instruments at Schwab Specialties Company, Pittsburgh, Pa. Strong, ductile, corrosion-resistant Monel is readily fabricated... assures long life in severe service.*



Gaskets for high temperatures

Typical Monel gaskets for lines carrying steam at high pressures and at temperatures over 500° F. are illustrated also. Since Monel is stronger at 1000° F. than mild steel is at room temperature, thinner and narrower gaskets can be used. Thus, stresses on flange bolts can be reduced considerably. Yet, despite its strength, Monel is so ductile that a gasket shapes itself to slight imperfections in the flange faces as the bolts are tightened, forming a sealed joint that stays tight at high pressures. Alternate heating and cooling do not embrittle Monel gaskets... ductility remains at a high level.

• • •

For further information about ductility and other properties of metals, write for the booklet, "The Technical Editor Speaks." A copy is yours for the asking. Address:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall St., New York 5, N.Y.

TENSILE STRENGTH-DUCTILITY CURVES
FOR SOME METALS AND ALLOYS

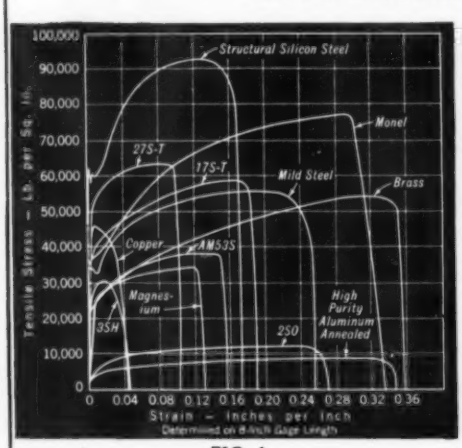


FIG. 1

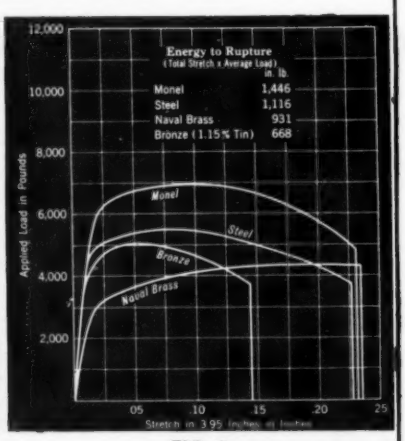
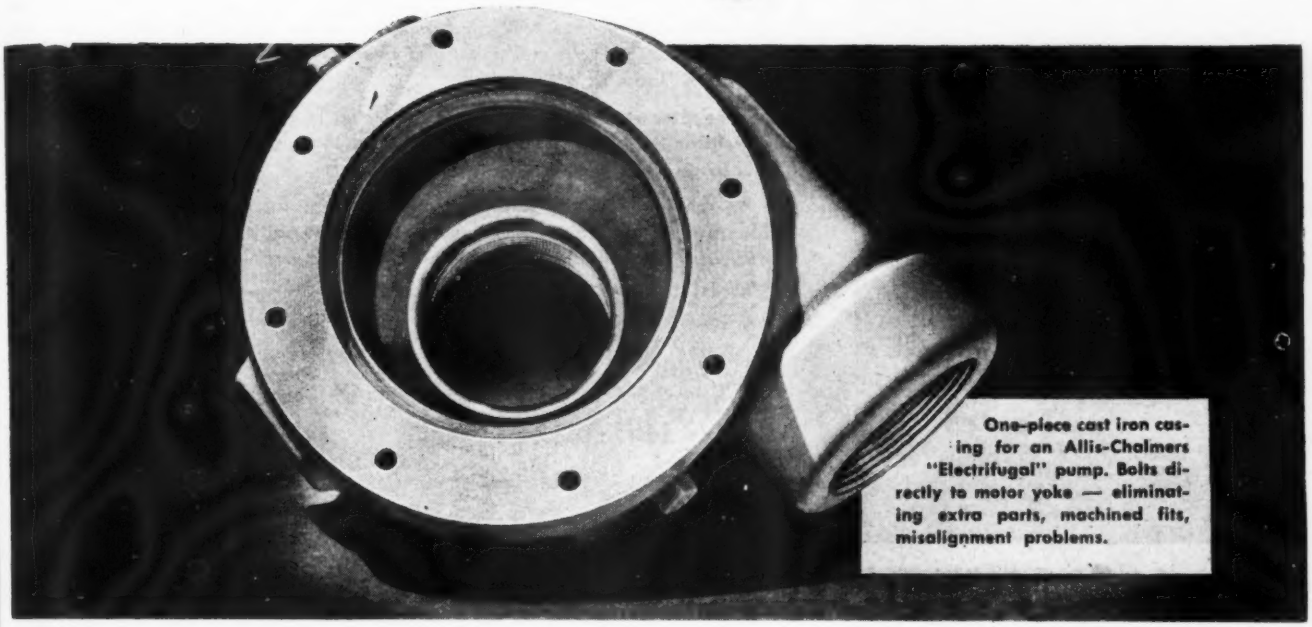


FIG. 2

[PUMP TIPS FROM ALLIS-CHALMERS—ONE IN A SERIES]

How to make CASINGS Last Longer . . .



One-piece cast iron casing for an Allis-Chalmers "Electrifugal" pump. Bolts directly to motor yoke — eliminating extra parts, machined fits, misalignment problems.

ABRASION AND CHEMICAL REACTION are the major causes of casing wear. For if liquid is gritty, or contains foreign matter; or casing is not constructed of the right materials for the pumping service required — casing life is materially shortened. A minor cause of direct casing wear is misalignment.

Original engineering of a pump can help prevent this wear. For example, Allis-Chalmers "Electrifugal" pump minimizes trouble from these sources in two ways: 1 — casings can be supplied in iron, bronze, stainless steel or other materials — depending upon type of service. 2 — It is a *unit-design* pump. Both impeller and motor are mounted on *one* shaft and in *one* frame. This means fewer parts, fewer fits — no chance for misalignment.

However, regardless of pump design, scheduled maintenance is still necessary if you expect to get longest wear from your casings. Some ways to do it . . .

▸Check all piping supports regularly to see that they're effectively supporting the load.

▸Every 6 months check piping itself to see whether it has shifted in any manner. Disconnect suction and discharge piping to see if it springs in any direction. Check the alignment of pump and motor — shimming up units as required.

▸Once a year clean and inspect casing for wear, deposits or pitting. Make necessary repairs.

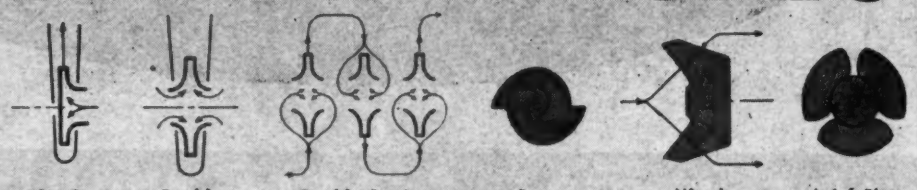
▸If foreign matter is being sucked into pump, wearing casing unduly, provide the intake end of suction piping with a suitable screen.

▸Send for your *free* copy of "Handbook for Wartime Care of Centrifugal Pumps". This valuable booklet applies to *all makes* of pumps; contains *no* advertising. ALLIS-CHALMERS MFG. CO., MILWAUKEE 1, WIS. A 1755

♪ *Tune in the Boston Symphony, Blue Network, every Sat. Eve.*

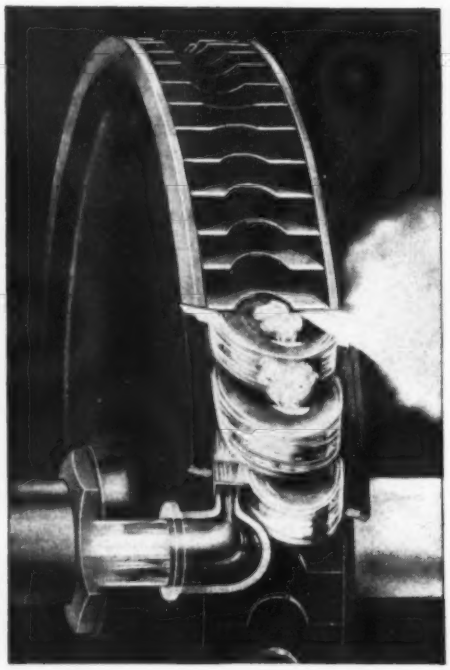
ALLIS-CHALMERS PUMPS

Allis-Chalmers builds all types and variations of pumps shown at right. Capacities from 10 to 150,000 gpm—heads to 2500 lbs.



Single Suction | Double Suction | Double Suction Multi-Stage | Open Impeller | Mixed Flow | Axial Flow (Propeller)

The TERRY



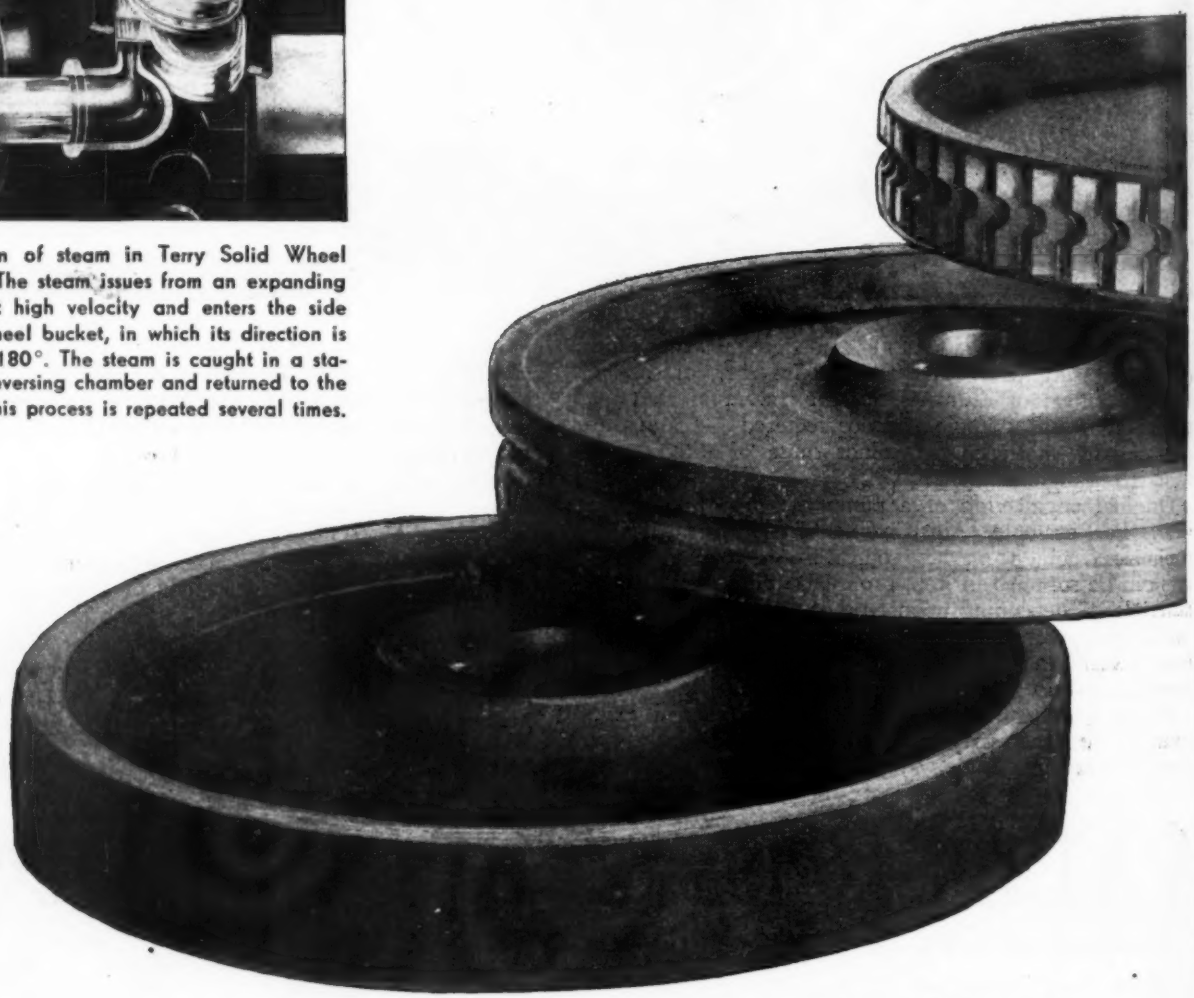
Action of steam in Terry Solid Wheel Turbine. The steam issues from an expanding nozzle at high velocity and enters the side of the wheel bucket, in which its direction is reversed 180°. The steam is caught in a stationary reversing chamber and returned to the wheel. This process is repeated several times.

USES A SOLID STEEL ROTOR

The rotor of the Terry Wheel Turbine is made from a single forging of special composition steel. The semi-circular buckets or pockets are milled from the solid metal. The steps in the machining of a wheel are shown below. There are no parts to become loose or work out.

The power-producing action of the steam in the wheel buckets takes place entirely on the curved surface at the back of the bucket and therefore close blade clearance is not necessary.

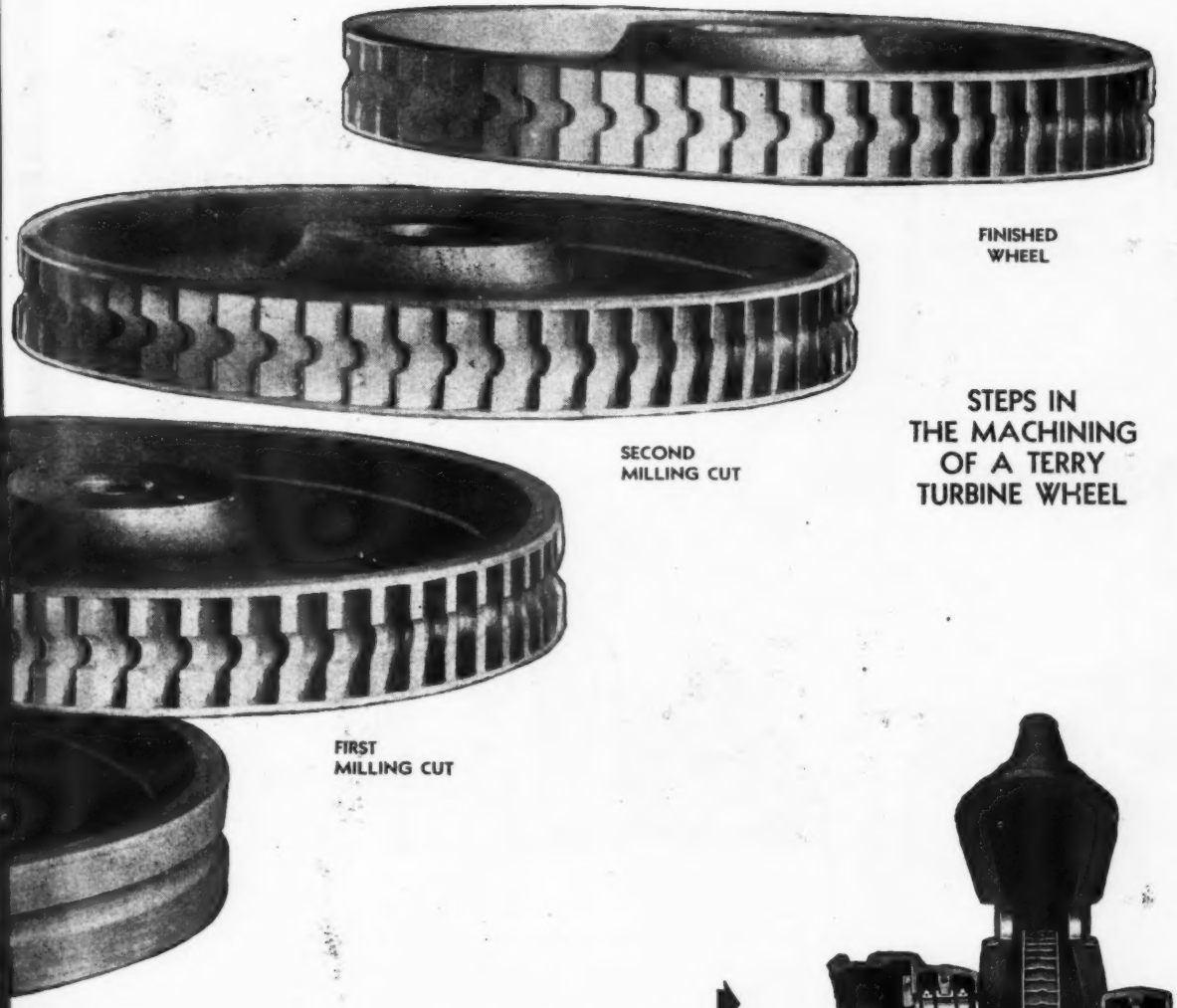
As the only function of these blades is to form a series of pockets, wear of the blades is of little consequence and does not materially affect the horse power or efficiency. The important part of the bucket is the back or bottom, which is a solid forging.



FORGING — ROUGH TURNED

THE TERRY STEAM TURBINE CO.

Wheel Turbine



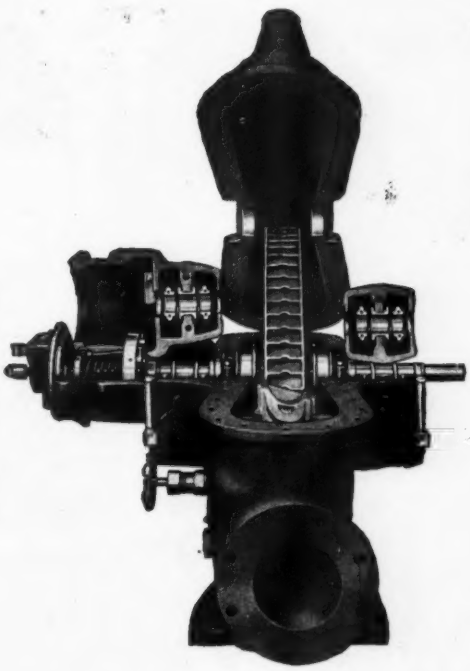
FINISHED WHEEL

SECOND MILLING CUT

FIRST MILLING CUT

SMOOTH TURNED

STEPS IN THE MACHINING OF A TERRY TURBINE WHEEL



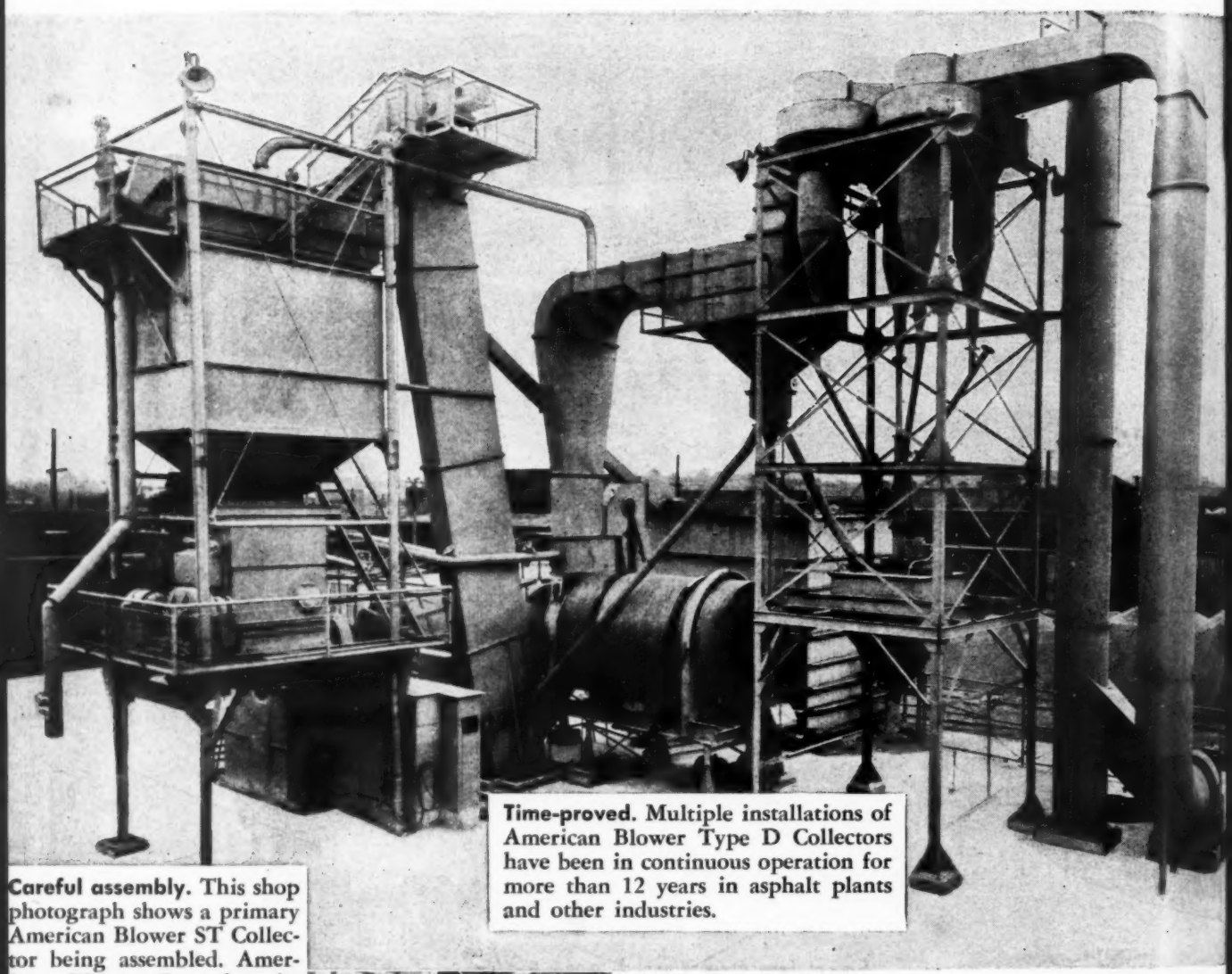
Typical Terry Solid Wheel Turbine with cover and bearing caps raised. Note the ruggedness and the accessibility of all parts. Units of this type are used to drive boiler feed pumps, generators, and all types of power plant equipment. Built in sizes from 5 H.P. to 2000 H.P.

FOR FULL DETAILS ASK FOR BULLETIN S-116

T-1156

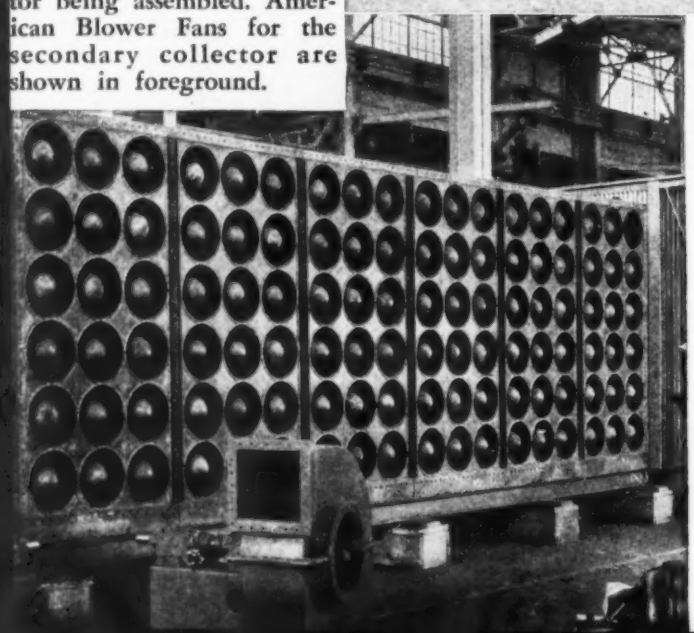
TERRY SQUARE - HARTFORD, CONN.

AMERICAN BLOWE



Time-proved. Multiple installations of American Blower Type D Collectors have been in continuous operation for more than 12 years in asphalt plants and other industries.

Careful assembly. This shop photograph shows a primary American Blower ST Collector being assembled. American Blower Fans for the secondary collector are shown in foreground.



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You are invited to inspect our facilities and to bring your dust problem along.

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CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.

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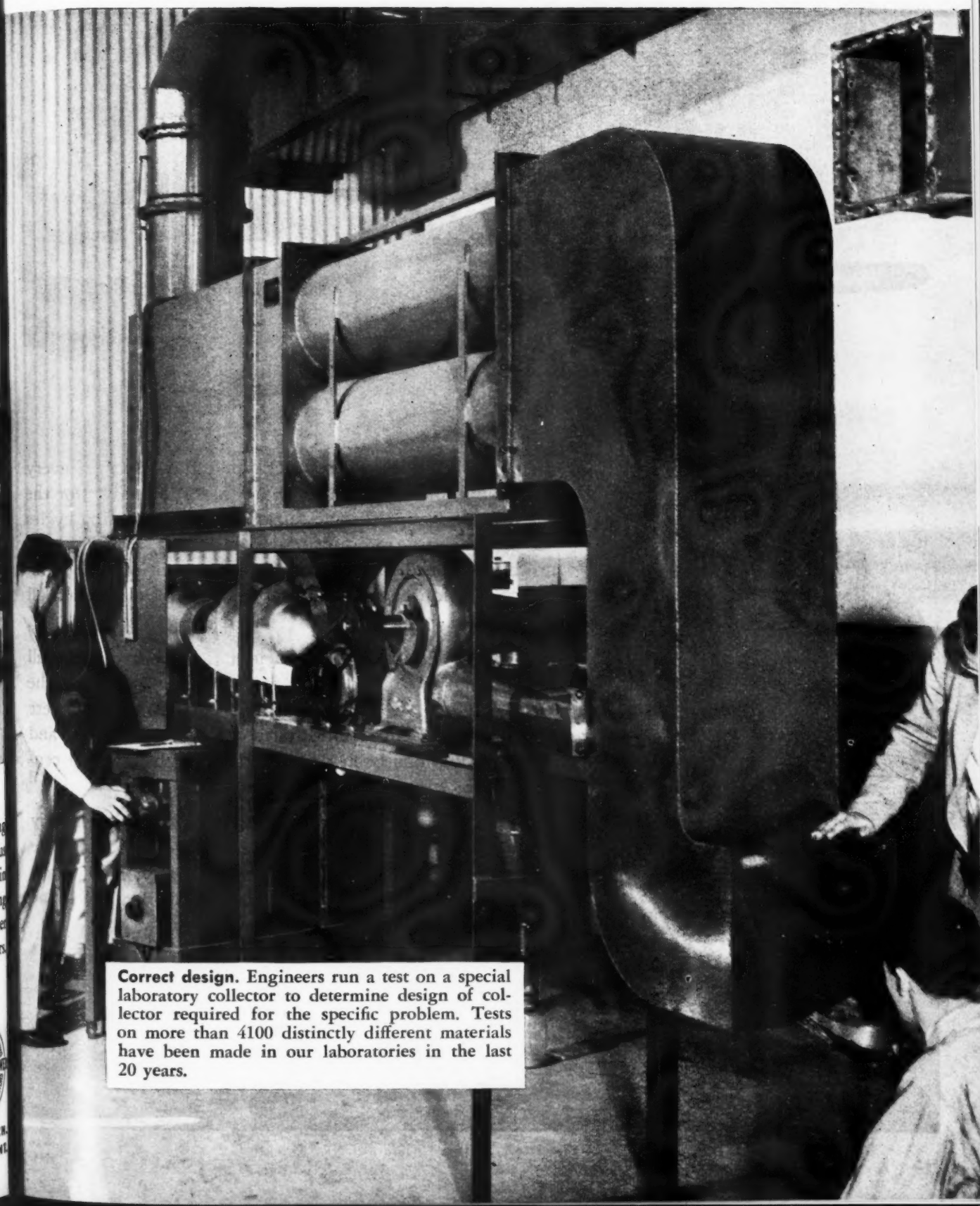
DUST COLLECTORS



Correct design. Engineers run a test on a special laboratory collector to determine design of collector required for the specific problem. Tests on more than 4100 distinctly different materials have been made in our laboratories in the last 20 years.

POWELL VALVES

. . for the duration

. . . . AND AFTER!

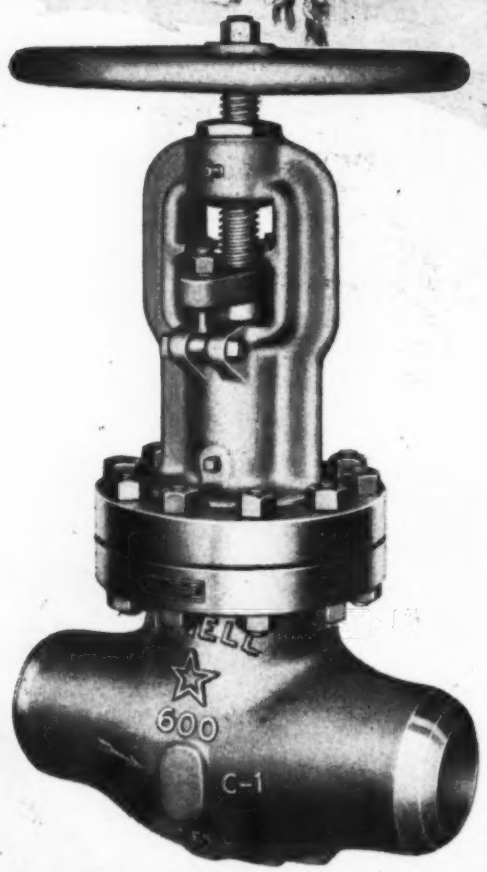


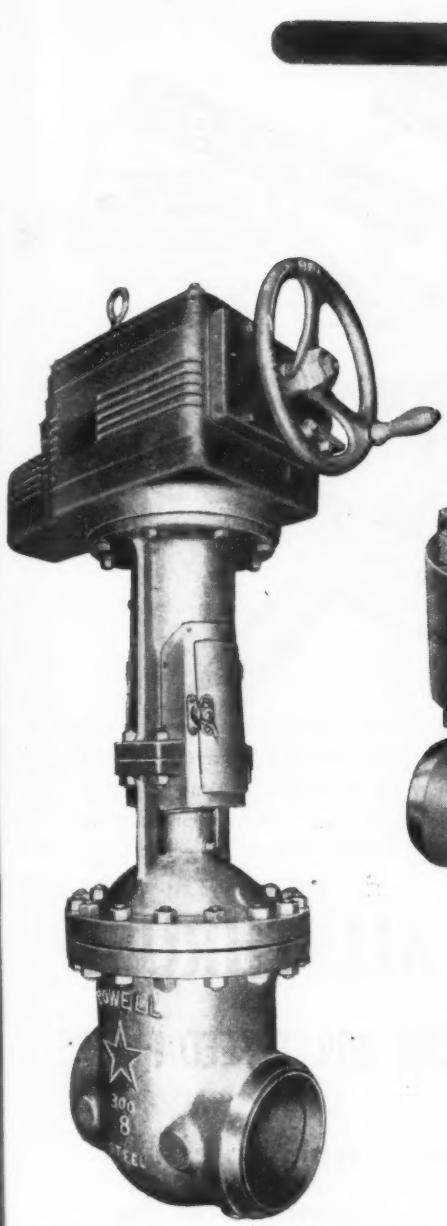
Fig. 6031-W. E.—Class 600-pound, Cast Alloy Steel, Welding End Globe Valve. Has outside screw rising stem, bolted flanged yoke, renewable semi-cone disc and regrindable, renewable seat ring. Sizes, 5" and larger are furnished with anti-friction bearing yoke and spur gears.

Powell Valves, now functioning flawlessly in every branch of War Industry, are good not only "for the duration" but for the durations of the coming cycles of peacetime production. Resultantly, Powell Valve buyers need face no scrapped installations when re-conversion comes, whether it come by degrees or all at once.

The basic principle of efficient flow control is, at all times, the *right valve,* in the *right spot,* for the *right job.* It is on this principle that the complete POWELL Line of industrial valves of all types and materials has been developed through nearly a century of successful valve manufacture.

The Cast Steel Valves shown here are especially adapted for power plant service. The POWELL Line includes Steel Valves of all types for working pressures from 150 to 2500 pounds and Boiler Feed Line Valves for corresponding pressures.

POWELL



8", Class 300-pound, Cast Alloy Steel, Welding End Gate Valve. An Electric Motor operator is mounted on top for quick, positive opening and closing.

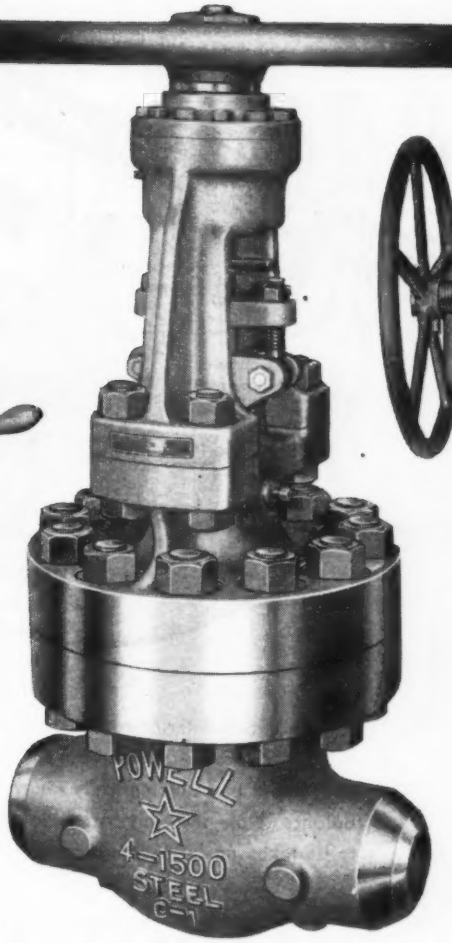
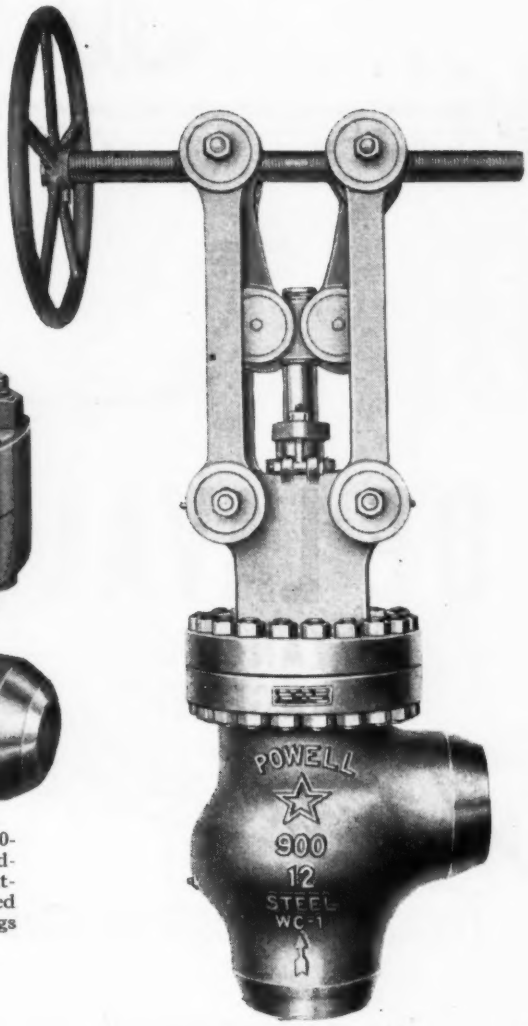


Fig. 1303-W. E.—Class 1500-pound, Cast Alloy Steel, Welding End Gate Valve. Has outside screw rising stem, bolted flanged yoke, renewable rings and taper wedge solid disc.



12", Class 900-pound Cast Alloy Non-Return Angle Valve, with welding ends. Toggle operated. Powell Non-Return Globe and Angle Valves are scientifically designed and engineered, with streamlined bodies that provide maximum flow area with minimum pressure drop. They can be supplied in various sizes and for all pressure classes from 300-pounds to 2500-pounds, inclusive.

The Wm. Powell Company

Dependable Valves Since 1846

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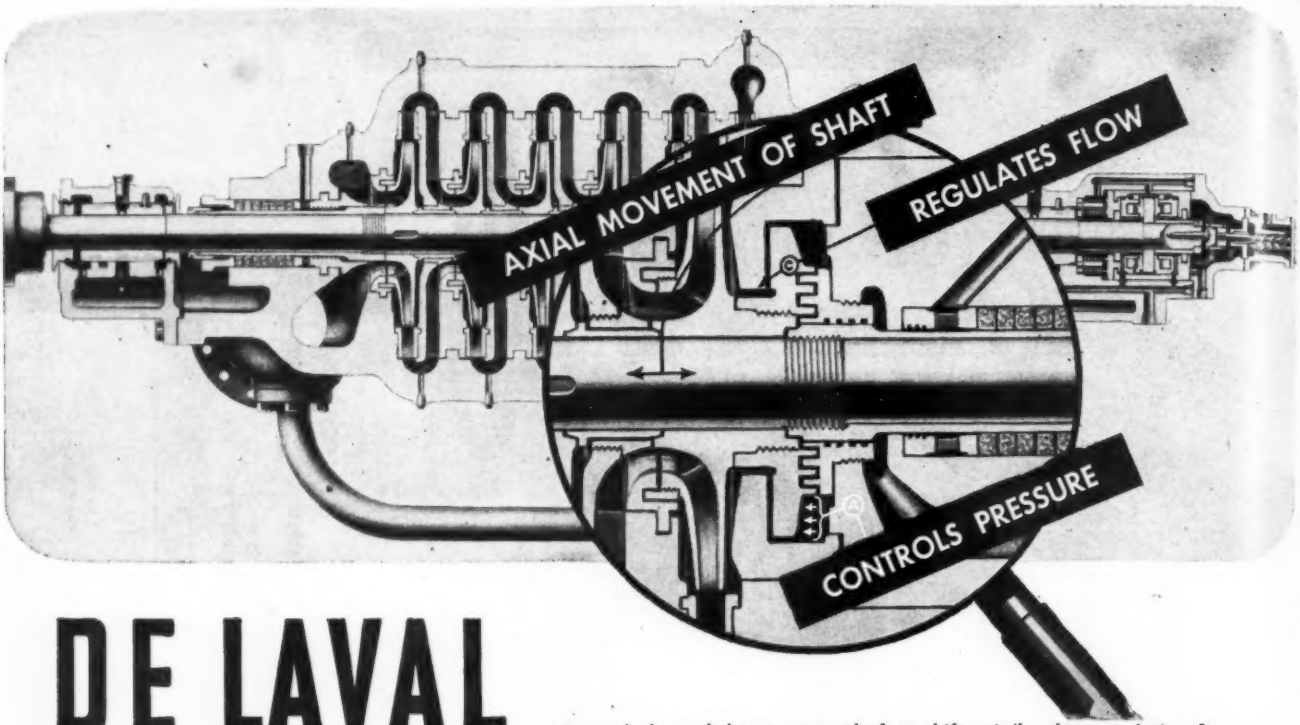
VALVES



DE LAVAL

BALANCING ARRANGEMENT *Automatically* BALANCES ALL THRUST

Any unbalanced thrust causes shaft to shift axially, thus regulating flow through clearance C, thereby controlling pressure against balancing disc A and thus automatically returning the pump to a state of perfect balance. Note that this hydraulic device leaves no unbalanced thrust to be taken up by bearings or other metallic contacts subject to wear.

ELIMINATES SOURCE OF TROUBLE IN HIGH-PRESSURE BOILER FEED PUMPS

The erosive action of high-temperature feed water in a high-pressure boiler-feed pump does not interfere with the operation of the De Laval automatic hydraulic balancing arrangement, since the automatic action of this device is in no way affected by normal wear, as can be seen from the illustration. Its universally trouble-free performance has been demonstrated over a period of 30 years in hundreds of installations, handling feed water up to 350° F. and discharging against pressures up to 1600 psi.

3630

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POWER

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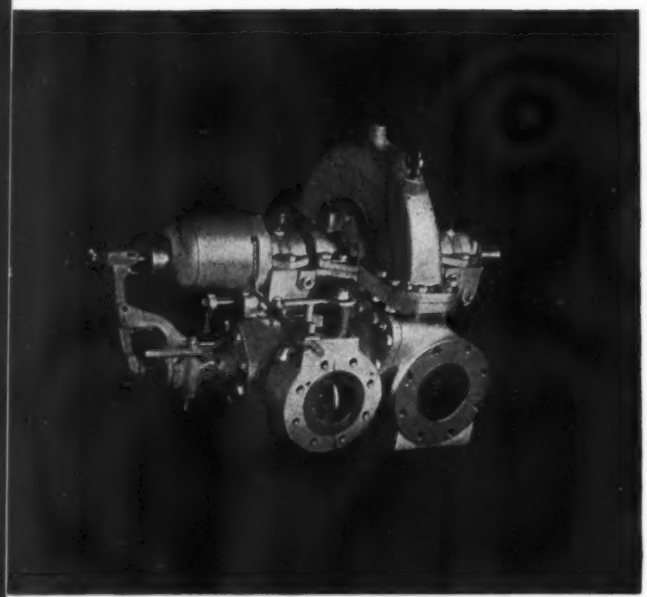
TO SOLVE YOUR MECHANICAL DRIVE PROBLEMS



Type C-14 Single-stage General-purpose Turbine. Built for service at 5 to approximately 200 hp; speed range 1000-5000 rpm. Suitable for use with steam pressures through 600 lbs. gauge, and for total temperatures through 750° F.

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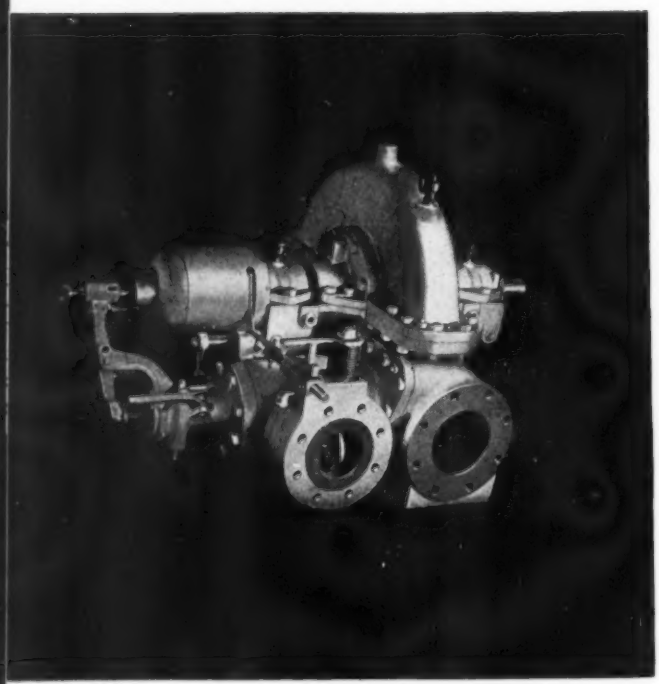

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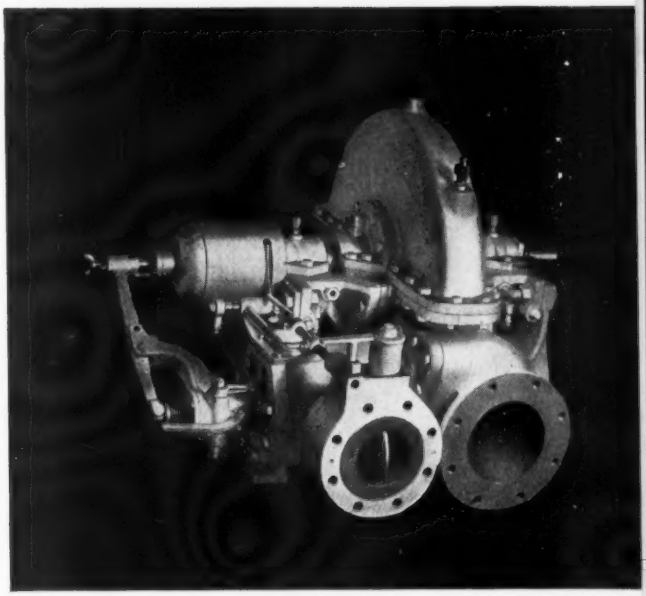

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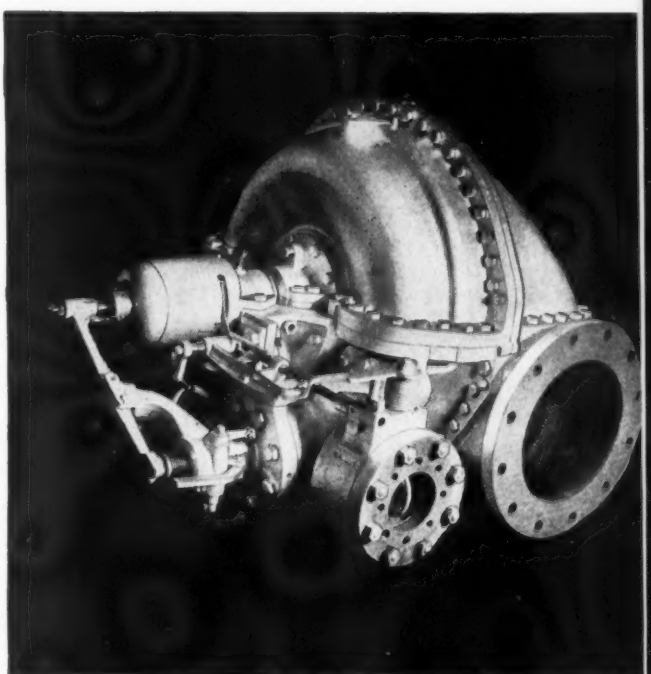
NATIONWIDE SERVICE. Installing your turbine—getting it running—and KEEPING it running is the responsibility of our nationwide Steam Service. Westinghouse turbines are built to keep service requirements at minimum. But in an emergency, your Westinghouse Steam Serviceman is as near as your telephone—ready to act as turbine trouble shooter . . . anywhere . . . any time of night or day. J-50446



Type C-225 Two-stage General-purpose Turbine. Built for services through approximately 1500 hp; speed range 1000-5000 rpm. Suitable for use with steam pressures through 600 lbs. gauge, and for total temperatures through 750° F.

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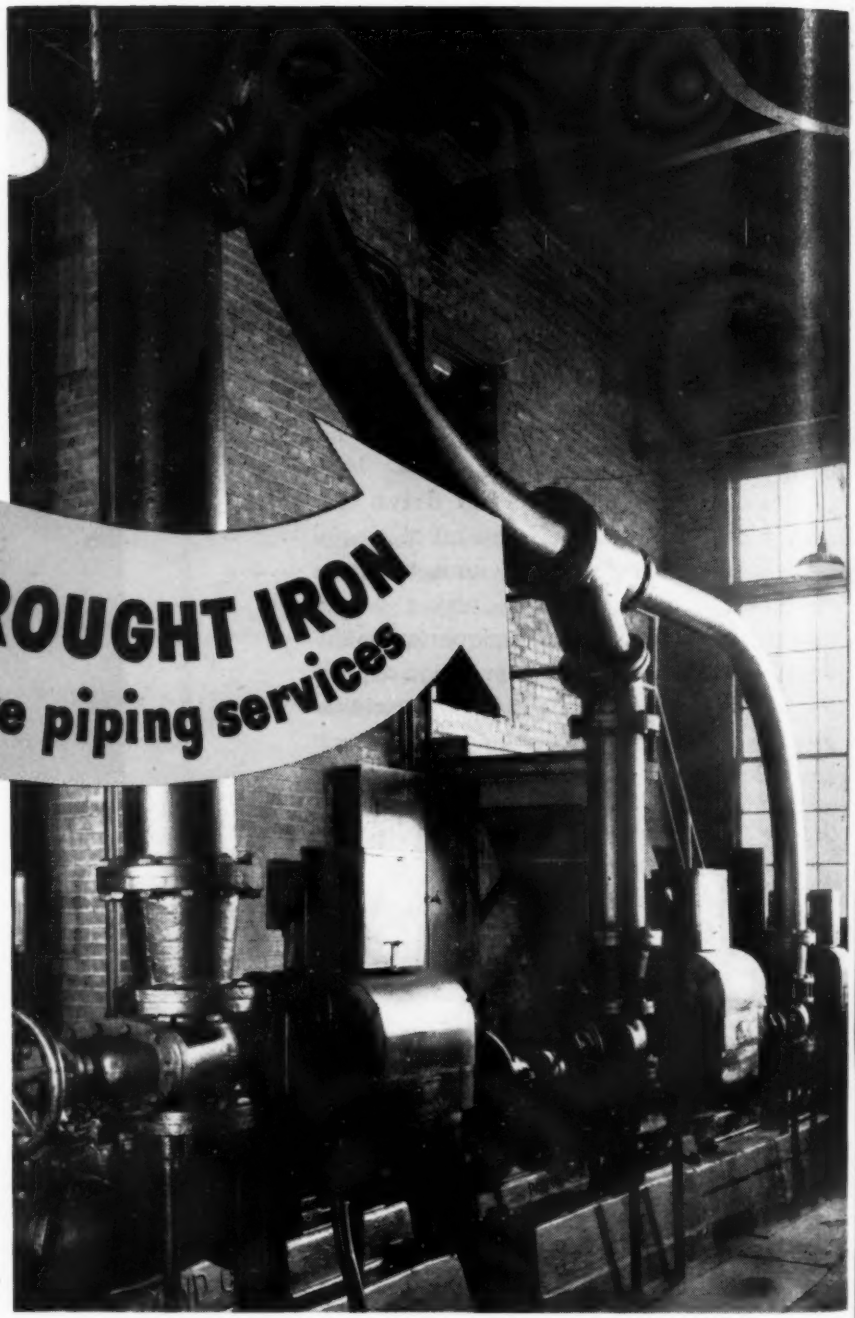
It's better to DO IT RIGHT than DO IT OVER



BYERS WROUGHT IRON for corrosive piping services

The wide variety of corrosive conditions encountered in the average plant makes the job of material selection a very complex one. Just recently engineers have reported problems in connection with obtaining durable pipe for heating coils in brine solutions; for a buttermilk condensing system; for water heating coils in veneer vats; for handling dried liquid chloride; for the piping of glycerine lye; and for after-coolers in gas plants. These are in addition to the run-of-mine problems of handling water, which can be one of the most difficult and aggressive corrosive agents of all.

In some instances it is possible to do something about the corrosive condition itself. But in all instances, the piping material itself will have the most to do with how the lines will last.

Byers Wrought Iron has served so long and so well that enterprising engineers are constantly finding new applications for it, and reporting results. As a consequence, our Engineering Service Department is able to answer queries like those above in terms of actual user experience. This permits selection to be made on the sound basis of actual field performance.

To find *why* wrought iron is so durable you need look no further than its structure. The high-purity iron matrix is threaded with tiny silica-slag fibers. These fibers are immune to corrosion and serve as baffles, preventing the rapid pitting that causes ordinary materials to fail. Furthermore, the initial film is "clinched" in place, thus helping to protect the underlying metal.

Our technical bulletin, "Wrought Iron for Piping Services," will give you some helpful general information. May we send you a copy?

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

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ELECTRIC FURNACE ALLOY STEELS • OPEN HEARTH ALLOY STEELS
CARBON STEEL TUBULAR PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • OCTOBER 1944 • ESTABLISHED IN 1882

FACING THE GRIM NEEDS of War, America's industrial power engineers learned how to improvise and carry on. Short of skilled help, denied new equipment and repair parts, stripped of maintenance periods by round-the-clock operation, they unfailingly powered the wheels of war production with every needed energy service.

To do so much with so little, these plants were "tied together with baling wire," so to speak. Clamped and patched, full of operating grief, they offended the eye, if not the pocketbook. They had no merit beyond the all-sufficient one of speeding victory by asking little and giving much.

They gave war industry the essential electricity, steam, air, water and refrigeration, but let the ships have most of the new turbines and boilers while they somehow carried on with decrepit and overloaded power units. Considering the circumstances, it was good engineering because it put first things first.

But that was yesterday, and it won't be good engineering tomorrow as the great War unwinds itself into the pattern of peacetime competition. Baling-wire plants and baling-wire technology are on the skids in America as Europe faces her final battles. Soon it will be possible and patriotic to buy a boiler, engine, pump, or steam turbine to save operating dollars.

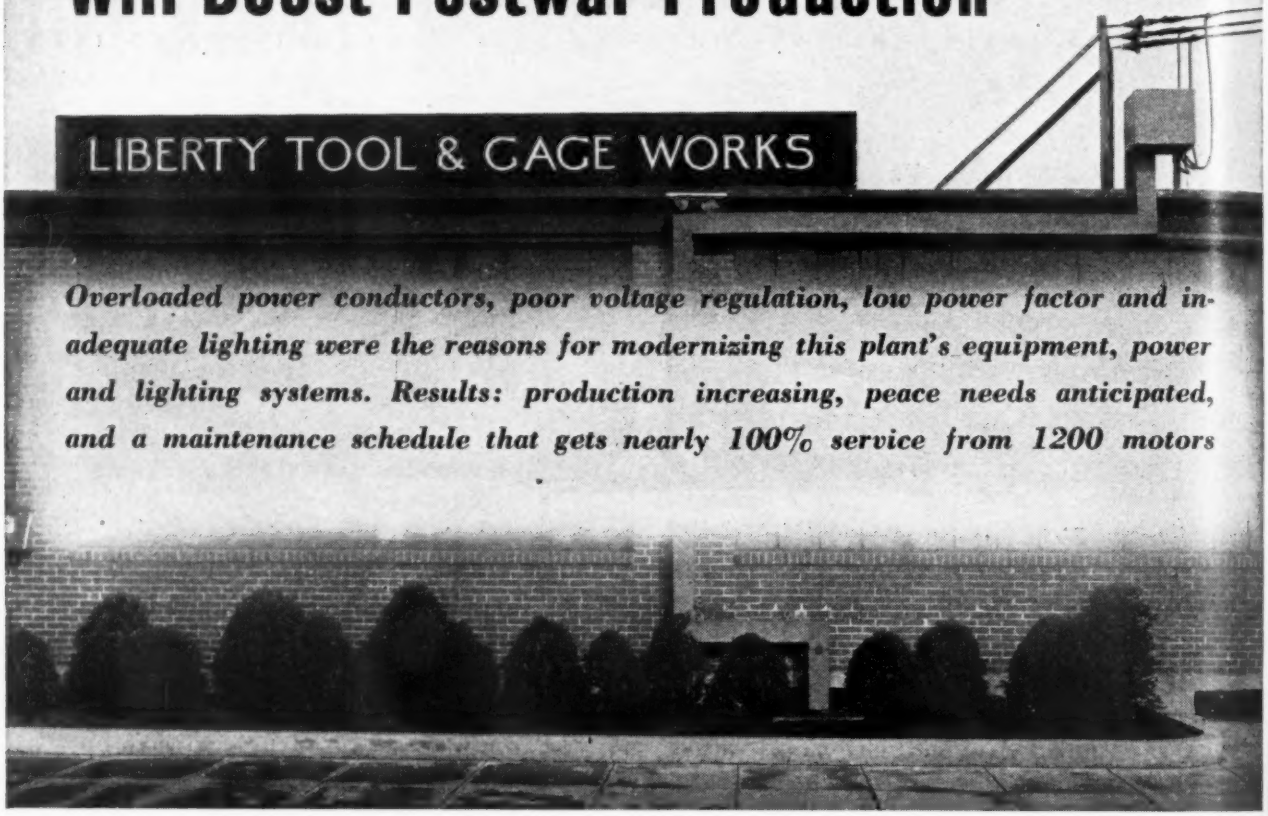
When Germany crashes, the Pacific war alone won't sustain present war-production levels. That's why business and government are rushing plans to convert factories to peacetime products.

Many manufacturers must allow months for retooling, but not the power equipment builders. Their units are pretty much alike in war or peace, so the plants that build them can "convert" overnight.

Power modernization can get moving the moment materials and men can be released for the job, and that will be soon.

Here is the chance for hundreds of power engineers to get rid of "baling wire" in a hurry—to rejuvenate their obsolete, war-worn plants for the keener competition that lies ahead.

Remodeled Power-Distribution System Will Boost Postwar Production



Overloaded power conductors, poor voltage regulation, low power factor and inadequate lighting were the reasons for modernizing this plant's equipment, power and lighting systems. Results: production increasing, peace needs anticipated, and a maintenance schedule that gets nearly 100% service from 1200 motors

Fig. 1—From the utility company's line on the plant roof, 1,000,000-cm cable loops to a tap box and inclosed busbars that run to the main distribution panelboard, from which inclosed busbar system of power and lighting circuits extend through the plant

► NOW IS THE TIME to start doing something about postwar planning, reports Liberty Tool and Gage Works, of Providence, R. I. Builders of high-grade tools, gages and special machinery for many years, this company expanded its plant so rapidly to meet war demands that its seriously overloaded power system was inadequate for present and future needs. Power factor was low, and voltage regulation poor. Lighting intensity was far below what is considered good practice. Moreover good lighting distribution was difficult because many machines were driven from overhead shafting.

After study of these problems, the company's engineers worked out a program to modernize power and lighting systems. It included eliminating some overhead shafting, rebuilding some belt-driven machines for direct or individual drives, changing all small traveling cranes from reel to trolley-bus power supply, and installing new power-distribution and lighting systems. The program was so planned that production would not be interfered with by the electrical staff's work, but would even increase as modernization progressed.

Plant Power Load

Plant power load included about 1200 squirrel-cage 550-v motors, from fractional to 35-hp rating. The larger motors connect to 110-v dc generators to supply magnetic chucks and other dc equipment in different parts of the plant. Most of the motors are rated 7.5 hp and less. Because of many overhead obstructions, large overhead units provided lighting, supplemented by local lighting wherever required. Much of the old power and lighting wiring was open, supported on cleats.

With the old system, power purchased at 600 v, 3 phase, 60 cycles was distributed to the motors at that voltage. It was also taken to load centers and stepped down through dry-type transformers to 208 and 120 v, 3 phase, 4 wire for lighting. For the new system, power is brought into the plant and distributed at the same voltage as for the old. The new distribution system, however, is practically a continuous busbar from the power company's connection box on the plant roof to points where taps are taken off for motors and lighting load centers.

Before laying out the new system an exhaustive study with meters was made of total load requirements, distribution in different parts of the plant, and power factor. It was decided to design the system for 1250 kva, 600 v at 0.90 pf, which will give about 25% excess capacity for future expansion, or for changes in manufacturing technique that may increase power consumption.

Conductor sizes were selected so that maximum voltage drop would not exceed 5%. Practically all 550-v motors will have slight overvoltage at their

terminals. Even though this may cause a small increase in no-load current of the motors, it insures operation at minimum full-load slip and current, with good voltage regulation—all of which are important in maintaining high production and quality.

Power comes from the utility company's pole-line transformers at 600 v, 3 phase over three 1,000,000-cm cables that deadend to a steel structure on the roof, Fig. 1. From the deadend, cables loop down into a tap box and connect to the ends of an inclosed system of busbars. They consist of six 2x¼-in. insulated copper bars, two per phase, in a metal housing, Fig. 3. Two bars in parallel have a cross-sectional area of 1,250,000 cm. To keep skin and proximity effects at a minimum the two bars of one phase interleave with those of the other phases. Busbars with their inclosure run directly to the main airbreak circuit breaker on the switchboard, Fig. 2, in the basement.

This switchboard has eight sections, each a complete unit with busbars at top and bottom. At any time it may be added to by removing a cover plate at either end of the assembly and pushing a new section in place. Only connections that have to be made are those in the busbar sections and distribution lines to the circuit breakers.

Right-hand panel of switchboard contains the main airbreak circuit breaker with magnetic overload trip, an ammeter, voltmeter and power-factor meter, and three ground lamps. A rotary switch connects each of the three meters to any one of the three phases. These meters with their switches permit a close check on the load current, voltage and power factor.

Second panel from the right mounts the power company's watthour and demand meters and their test blocks. Each of the four left-hand switchboard panels contains two 225-amp dead-front thermal-overload-trip circuit breakers. These breakers connect to vertical busbars by plug-in connections. Incoming power bus, after passing through the main circuit breaker, connects at top and bottom of panelboard to a horizontal busbar from which power is distributed through 225-amp breakers.

Power and lighting loads are each supplied by four sets of inclosed busbars run from the distribution panels. The power-inclosed busbars, of a size selected to maintain from 550 to 575 v at motor terminals, are supported from the roof trusses over the production-machine areas. Busbars with their inclosures are so designed that combination plug-in switch and protective-device connections for each machine can be made at the most convenient point. From the plug-in connections, wiring to the motor control runs in solid and flexible conduits to the motor. Thus, all circuits are metal inclosed from the connection box on the building roof up to motor terminal boxes.

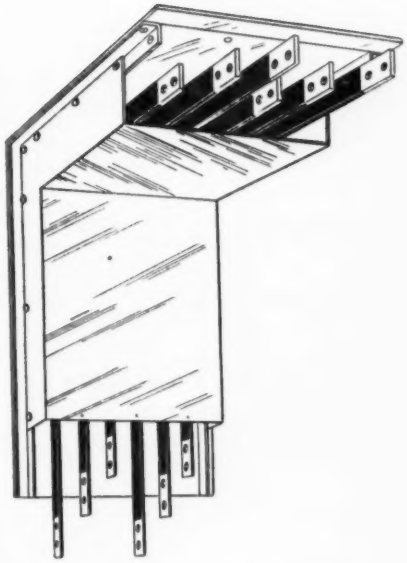


Fig. 3—Busbars from plant roof consist of six 2x¼-in. insulated copper bars

Fig. 2—The incoming power conductors connect to the busbars on this panelboard, from which eight inclosed busbars run to 1200 motors and the lighting system

Capacitors Correct PF

A 4-section 60-kva capacitor connects to the end of each distribution bus. This location of capacitors provides maximum benefit because power factor is corrected and the whole system's voltage regulation improved. Under normal load, these capacitors improve power factor to about 0.90.

Each of the four sections making up a capacitor group is fused. A small indicating lamp with lens connects in parallel with each fuse. If a fuse fails, its lamp lights to show the electrician where the fault is. Without these lamps, one or more sections might be open without being detected. If power factor shows below normal on the switchboard meter, inspection of the capacitor signal lamps shows whether a blown fuse is the cause.

Lighting-circuit inclosed busbars run from panelboard to distribution centers where the 600-v 3-phase power is stepped down through dry-type trans-

former to 208- and 120-v 4-wire 3-phase for the lighting loads. In the new system, individual lighting units have been replaced by continuous fluorescent lighting. Over each row of machines, or working aisle, a continuous reflector is installed that contains four parallel rows of 48-in. fluorescent lamps. Illumination intensity has been increased from 15 and 20 foot-candles of the old system to 50 for the new. Where work requires it, provision is also made for local lighting.

Instead of the former reels, trolley-bus systems now provide power to all overhead traveling hoists. This system consists of channel-shaped copper conductors in an insulated steel housing. A trolley that connects to the traveling hoist takes current from the bus-bars. Trolley bus runs the full length of the hoist rails; therefore hoist travel is not limited as with a cable reel and other objectionable features are eliminated. Two or more hoists can operate on the same rails and from the same trolley bus, each hoist supplied through its own trolley.

After electrical equipment has been correctly selected and installed, it must be properly maintained. In metal-working plants, oil, metal and abrasive dusts are ever present enemies of electric-circuit and motor insulation. The following system of preventive maintenance practically eliminates unexpected failures. All motors are checked each day for lubrication, temperature and general operation. Every two weeks each motor's insulation resistance is tested with a Megger. If insulation tests low, motor is replaced and taken into the shop, cleaned with compressed air and oil-and-grease solvent, and dried out. If insulation can be restored to normal, windings are given a coat of good insulating varnish and allowed to dry. If insulation cannot be restored, windings are high-voltage tested to break down the weak spot after which the defective coils are replaced, or if necessary the motor is completely rewound.

At least every six months, each motor is carried to the shop where bearings are checked, cleaned and lubricated; windings are washed, dried and given a Megger test. When insulation is in good condition after cleaning and drying, which it generally is, the windings are given a coat of insulating varnish and dried. Anti-friction bearings are grease lubricated and generally require attention only when a motor is cleaned.

Motor Maintenance

As previously mentioned, oil, metal and abrasive dust cause most motor failures, but overhauling the motors every six months practically eliminates such trouble. Between semiannual overhauls maintenance consists chiefly of keeping motors clean, lubricating ring-oil bearings and guarding motors against abnormal conditions.

Each motor record is maintained on a card, Fig. 4. At the top, motor's location and complete data on its various parts and history are recorded. On another part of the card is the motor's load and power factor, as obtained by test when the machine is installed, and subsequently if the motor appears to operate under abnormal conditions. The two lower sections are for motor repair and maintenance records.

All electrical design, installation and maintenance work are under F A Merrill, plant electrical engineer. He designed the new power system with the cooperation of engineers of Trumbull Electric Mfg Co, and General Electric Supply Co. Switchboard, all inclosed busbars and trolley bus were supplied by Trumbull Electric Mfg Co. General Electric Co furnished the main circuit breaker, capacitors, lighting transformers and fluorescent lighting.

ELECTRICAL EQUIPMENT RECORD

Description .....

Dept. ..... Building ..... Machine No. .....

Mfg. By ..... Serial No. .....

H. P. ..... R. P. M. ..... Volts ..... Amps. .....

Base Size ..... Bolt Holes ..... Shaft .....

A. C. or D. C. ..... Cycles ..... Phase ..... Bearing .....

Style No. ..... Form ..... Frame .....

Type ..... Model .....

Winding ..... Temp. .....

Control .....

History .....

SERVICE RECORD

DATE	BLDG.	SERVICE	POWER FACTOR	TESTED LOAD	
				VOLTS	AMPS

REPAIRS

DATE	CONDITION	DUE TO	REPAIRED BY	COST

Greased		Maintenance		Cleaned	
DATE	BY	DATE	BY	DATE	BY

Fig. 4—A record of each motor in the plant is kept on a card like this, which gives its location, parts data, load, power factor, repairs and maintenance

Knowing What Goes on Inside Pulverized-Coal System PREVENTS FIRE

Scrutinize your coal-handling equipment with the help of 33 practical pointers.* Fire prevention week, Oct. 8-14, calls for a safety checkup

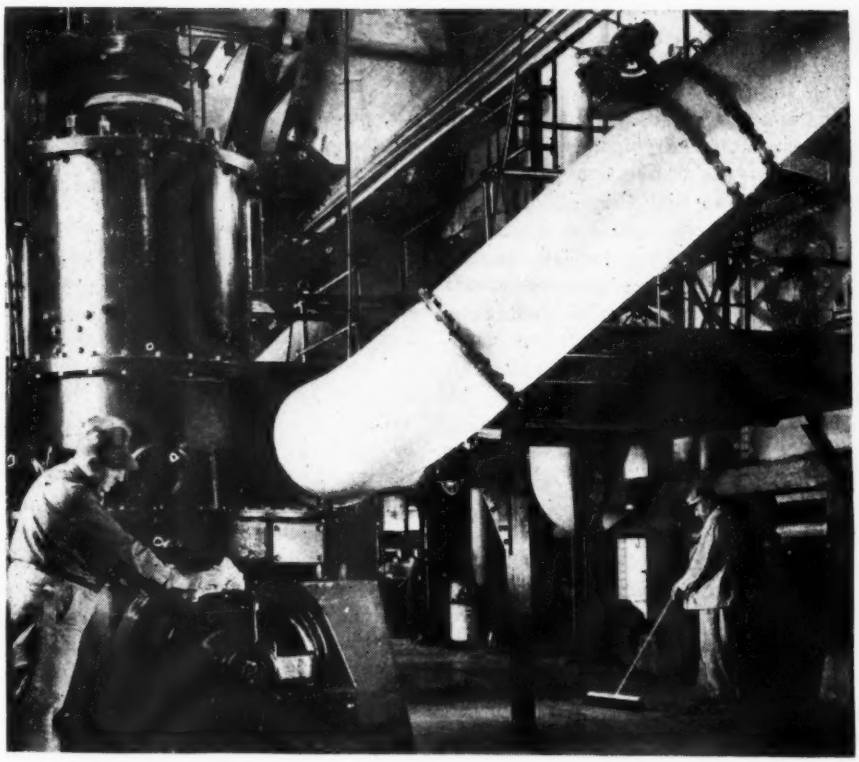


Fig. 1—Do not permit pulverized coal to accumulate on beams, floors, piping or machines because it creates an explosion hazard if stirred up in a cloud of dust

▶ PULVERIZED COAL dispersed in a dust cloud has nearly the same characteristics as gas, with two exceptions. First, it is safer to handle because it does not ignite as readily; second, always being mixed with a certain amount of air, it is subject to spontaneous combustion and in this respect more hazardous than gas.

Many practices recommended for handling gas apply to pulverized coal. For instance, danger becomes greater if the combination of leakage and an ignition source, such as open flame or sparks, is present. Take every precaution to confine fuel until it reaches the furnace.

In its raw state before being dried or crushed, coal usually does not present a serious explosion hazard. Principal precaution is against spontaneous ignition. Because coal dust on walls and supporting beams of conveyor houses may cause an explosion when it is disturbed, prevent large dust accumulations by putting sharp angle covers on beams. Remove dust daily.

Crushed and dried, or pulverized, coal in storage is especially susceptible to spontaneous ignition. Make every effort to store only a small quantity because drying greatly increases its tendency to ignite.

Hazards of drying by injecting the heating medium into a mill depend on mill characteristics. In a system using air separation there is a brief period during starting and shutting down when coal and air mix in such proportions that a flame or spark can set off an explosion. Do not permit heated air to enter an idle mill. Also make every effort to prevent pulverized coal accumulating at any point in the system.

* Excerpts from "Pulverized Coal Systems," National Safety Council

Four driers in common use are: (1) direct (2) semidirect (3) indirect and (4) mill type. Direct or semi-direct driers usually have special furnaces. In indirect driers, furnace gas, steam or hot air supplies the heat. First three driers listed usually dry raw fuel. In the mill type, coal is dried during pulverizing by heated air introduced into the duct where coal enters the pulverizer. After picking up moisture from the coal, the air is expelled beyond the pulverizer.

Watch Drier Temperature

Investigations show that, directly or indirectly, excessive drier heat causes many fires and explosions in pulverized-coal plants. Other fires occur in a quantity of coal that remains inside a drier when heating continues after the drier drum stops revolving. When drying coal, keep it moving. Never allow it to accumulate in connecting flues or other parts of the system.

Overheating in the pulverizer can be prevented: (1) When mill is shut down, by interlocking mill power and heated-air control supply so that when the mill stops hot air cannot enter. (2) When mill is in operation, by holding a safe temperature at the mill discharge pipe. This varies with different coals, but 90 to 125 F dries coal safely. Maintain lowest temperature that gives satisfactory results, especially if dried coal is stored in bins before it goes to the pulverizer.

To maintain a check on the drier's temperature install a temperature indicator and alarm system for the drier attendant, and a temperature recorder where fire or explosion will not damage it.

To reduce mill-discharge temperature, lower drying-air temperature instead of reducing quantity of air introduced. When air flow must be reduced to decrease dust losses, operate driers at minimum velocity.

In direct and semi-direct driers combustion gas should not come in direct contact with the drying coal, except at a distance from the fuel bed of at

least one half the drier length, and never less than 12 ft. Drier design should prevent combustion gas entering when the shell is not in operation. Use coal with high ignition temperature in these driers because of danger of spontaneous ignition from overheating. In some direct driers sparks may carry over from the fire and cause ignition.

Always shut off the coal feed and run the drier empty before stopping it or shutting down. If the drum must be stopped while it still contains coal, extinguish the drying fires at once or bypass the combustion gas, steam, or hot air, so that the coal does not continue to heat.

In indirect driers, dust on heating coils and other heater parts sometimes causes fires. Keep heater free from such accumulations (1) when starting up, by allowing air to flow through the heater before turning on steam (2) when shutting down, by maintaining air flow long enough to cool the heater after steam is shut off.

Keep Below 150 F

When coal is sent directly from drier to storage bins, do not permit its temperature to exceed 150 F. Operate so that no dried, unground coal remains in the plant when it is shut down more than 24 hr. Should longer storage periods be necessary, check coal temperature every day. If it tends to rise, test coal every six hours because final stages of combustion take place rapidly.

Before feeding dried fuel to a crusher or pulverizer other than the ball-and-tube unit, first pass the coal through or over a self-cleaning magnetic separator to remove tramp iron which might strike sparks in the pulverizer. Some plants locate a separator ahead of the primary crusher.

Safeguard against coal passage when the separator is not magnetized by either an interlock or a suitable alarm system which notifies the operator that the separator is not functioning. One large separator may serve a group of pulverizers. Take particular care to prevent foreign matter entering the fuel supply after it passes the separator.

Where possible, locate the pulverizer in a detached building. If this is impracticable install it in an area separated from the rest of the building by masonry walls and floors. Provide vents in outside walls to relieve pressure in event of an explosion.

If the room cannot be kept dustfree, use oil circuit breakers on power feed circuits; install air break switches and contactors outside. Modern pushbutton wiring facilitates remote control. Also provide for cutting off light and power at some remote point in an explosion or fire. Use only nonsparking or explosion-proof motors for drive. To prevent arcing, ground electrically, shafting, belts, machines and metal equipment.

Feeding too-hot coal into the pulverizer may cause an explosion because it contains suspended dust. Run the pulverizer empty before shutting it down.

Outlet Air Temperature

Fires in unit pulverizers during operation are infrequent, and those that do occur are usually put out without damage to equipment or interruption to operation. Fires may originate from (1) too-high temperature of pulverizer air (2) fire in raw fuel bunker and (3) fires started in idle equipment by welding. Fire in an operating pulverizer shows up as an increase in outlet fuel air temperature that cannot be accounted for otherwise. Moreover, this increase is sudden and of considerable magnitude, usually 100 F or more. Maximum normal outlet temperature should not exceed 160 F.

A pulverizer stopped in an emergency contains a considerable amount of partly pulverized fuel. Allowing the hot pulverizer to stand in this condition for some time may cause the fuel to ignite. Return equipment to service as soon as possible or clean it by the manufacturer's instructions.

Pulverized fuel is usually transported from mill to bins or burner by screw conveyors or some type of air transporter. In the latter, maintain less than 5 lb of air per pound of coal to minimize danger of creating an explosive mixture.

Take precautions to prevent pulverized coal jamming and caking in screw conveyors, elevators or pipes because this increases the danger of spontaneous ignition. Clogging is sometimes caused by coal that is stored too long. Being dry, it absorbs moisture readily, which causes it to pack. Never try to break a jam by hammering on pipe or bins because this may cause a joint to leak.

Prevent leakage from pulverized-coal pipelines. All main transporting lines should be free of baffles, valves or obstructions that might accumulate coal. However, a positive check or stop should be installed in each branch line to a burner so that it may be shut down without stopping the entire system. Never run coal-carrying pipelines over a furnace where they may be subjected to external heat.

Should a coal circulating line become clogged, cut the furnace out at

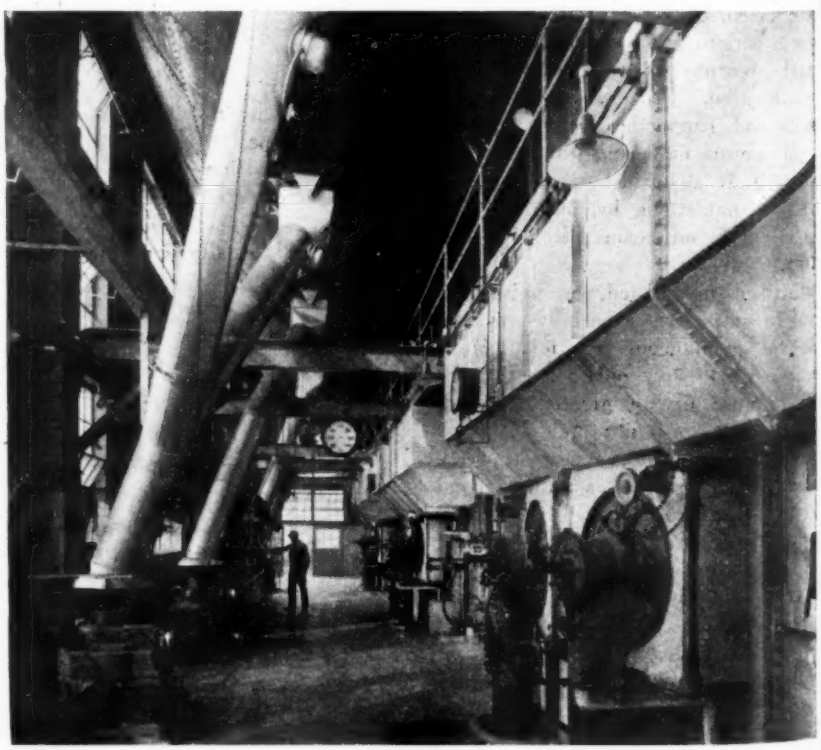


Fig. 2—Alarm systems on storage bins signal the operator when raw coal supply gets low. Double downspout permits taking coal from one or both ends of the bin

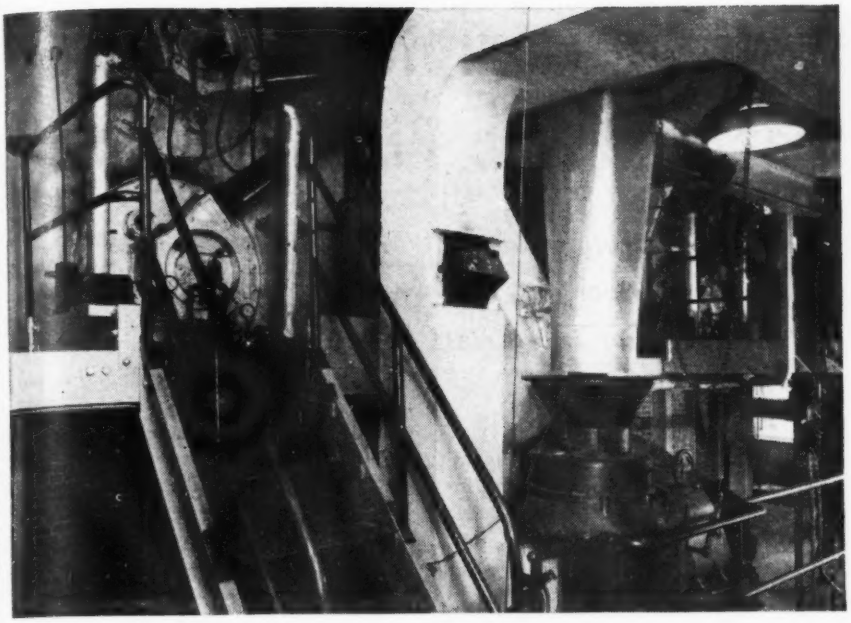


Fig. 3—**Built-in lighting torches encourage operators to light each coal burner individually rather than depend on previously lighted burners for ignition flame**

once and stop the secondary air flow. Make sure no smoldering particles of fuel are present before starting up again. Blow the circulating line clean of fuel when the pulverizing plant is shut down.

When using the fan to clear a mill of coal, start the boiler induced-draft fan or open the stack damper wide before starting the mill and exhauster. Better still, interlock the system so that mill and fan cannot be started ahead of the induced-draft fan. Always place a lighted torch in front of the furnace burner even though the boiler is shut down. Inspect all equipment regularly for smoldering fires, particularly before opening for repairs. Lacking air, a fire may smoulder during operation without damage. Opening the system and starting repair work may create proper dust suspension for an explosion.

Overheated Bearings

Pulverized-coal blower rotor bearings should not extend inside blower casing or ducts because an overheated bearing may ignite the mixture of coal dust and air. When two blowers operate in series, one for a primary air and the other for secondary or booster effect, always maintain the primary air pressure higher than the secondary. If one blower stops, the other should stop automatically. Many installations arrange to shut the coal supply off also, thus preventing fuel accumulation in the furnace. To prevent leakage of fine dust, make connections between blower discharge and main duct dust tight.

Whenever possible, locate dust collectors in separate rooms from other equipment. All units except the cloth type should be of noncombustible material. Provide cloth type collectors with dusttight metal inclosures, solidly grounded electrically. Cloth can be grounded by sewing or weaving wires into the fabric.

Provide safety relief vents on all pulverizing equipment, particularly in the pulverizer discharge at top of pulverizer return duct, at elevator heads, storage bins and dust collectors. Storage-bin vents should have a cross-sectional area large enough to permit separation of air from coal without building up abnormal pressure within the bin. Make those for pipes and flues of at least the same area as the ducts vented. Carry them by the most direct route practicable to the outside air in a direction as nearly vertical as possible without deviating more than 22½ deg from direction of pipe or flue travel, from which they leave. Avoid horizontal runs.

Pulverized coal flowing into storage bins creates a cloud of dust inside. Avoid any possibility of igniting this potential explosive mixture by keeping bins tightly closed except for a relief vent to atmosphere.

Locate pulverized-coal-storage and furnace bins as far as practicable from furnaces, open flames, open lights or other equipment that can materially raise temperature of fuel. Also protect them from excessive cold because cooling condenses moisture in the bin, which may cause caking.

Make bins of noncombustible material with smooth interiors, shaped so that coal flows freely when discharge valves are open. Provide reliable indicating devices to warn operators before there is danger of overflowing. Remove the manhole cover at intervals during shutdown to inspect for increased coal temperature or fumes from smoldering fire. Heating in pulverized-coal storage can be checked closely by installing a thermocouple inside the bin and connecting it to a warning device on the operating floor.

Always clean out all equipment before a shutdown of more than one day. When a plant has been idle two days or more, inspect all storage bins for hot or burning coal before resuming normal system operation.

Save Paper for That Happier Tomorrow

This magazine weighs over a pound. One pound of paper, salvaged, will make:

1 fin-locknut protector for a bomb
11 cartons, each containing 15 .50-caliber shells
21 cartons, each containing 15 .45-caliber bullets
2 containers for blood plasma
2 containers for field rations
15 boxes for emergency lifeboat rations
21 cartons, each for a life-preserver light
29 cartons, of 10 cartridges each, for inflating lifeboats
7 cartons for U. S. Army K rations
11 cartons, each holding 120 boxes of yellow-fever vaccine

There is no such thing as "waste" paper today—save every scrap you possibly can for the big scrap we've got to win. Paper saved today will fight for you tomorrow!

Commonwealth Edison Completes Largest Wartime Unit at Historic Fisk Station

New 147,000-kw 1250-psi 925-F single-shaft turbine and two 750,000-lb-per-hr boilers already play an important role in meeting the power demands of Chicago war industries

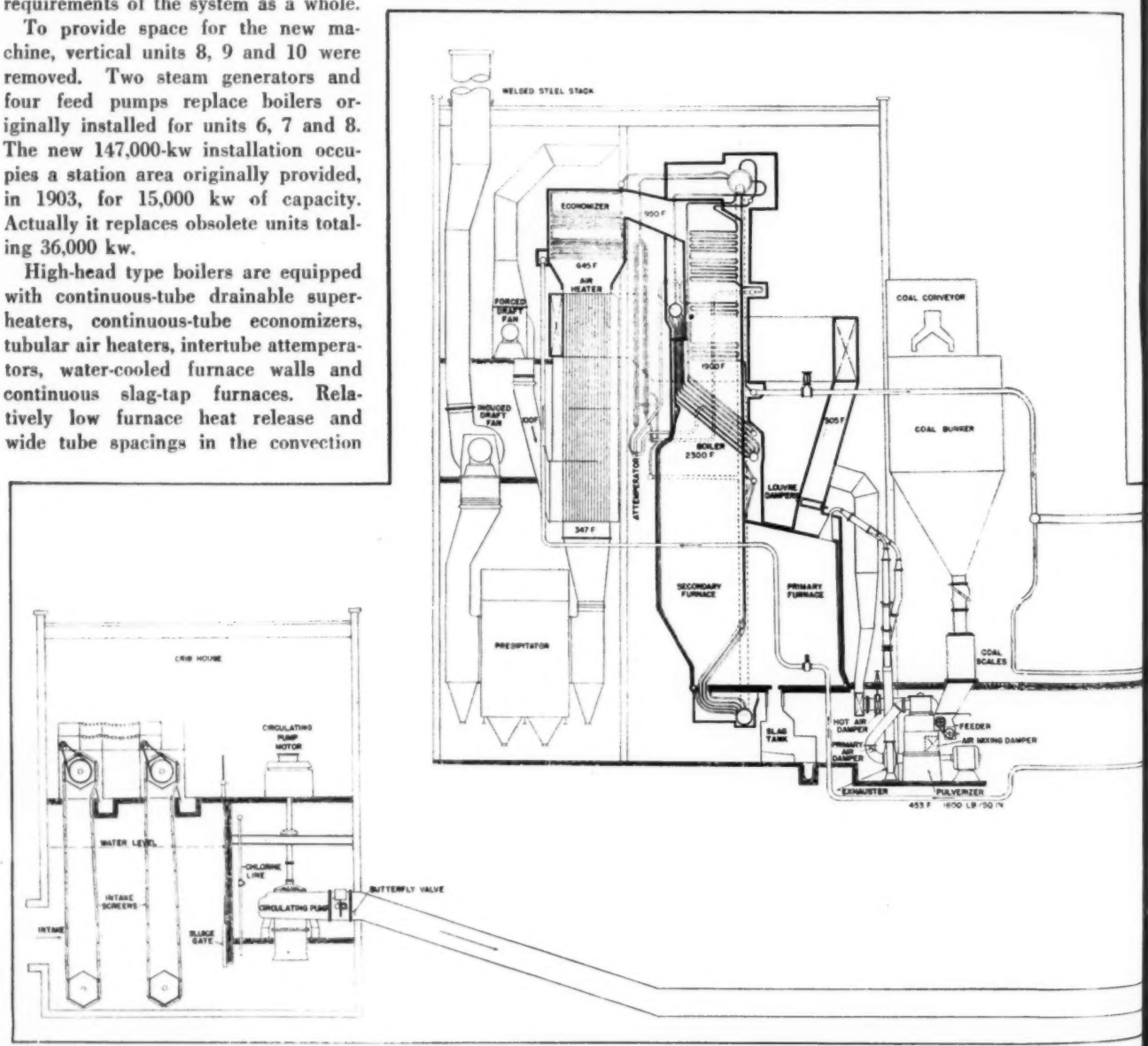
► Latest addition to the Chicago-area power pool is installed at Fisk because of the station's proximity to the center of load and the economies possible in replacing three outmoded, inefficient machines. Adoption of 147,000-kw size was dictated by two factors: space-saving advantage of compact design and the estimated additional capacity requirements of the system as a whole.

To provide space for the new machine, vertical units 8, 9 and 10 were removed. Two steam generators and four feed pumps replace boilers originally installed for units 6, 7 and 8. The new 147,000-kw installation occupies a station area originally provided, in 1903, for 15,000 kw of capacity. Actually it replaces obsolete units totaling 36,000 kw.

High-head type boilers are equipped with continuous-tube drainable superheaters, continuous-tube economizers, tubular air heaters, intertube attemperators, water-cooled furnace walls and continuous slag-tap furnaces. Relatively low furnace heat release and wide tube spacings in the convection banks and superheaters prevent slag fouling. Effective slag removal is attained with the mechanical blower installation, composed entirely of retractable blowers in the boilers, superheater and economizer sections. Heat-absorbing surfaces are arranged to facilitate effective mechanical cleaning.

Particular attention has been paid to obtaining adequate and effective boiler-water circulation; no tube failures have yet occurred. The steam-generators have been in service approximately a year longer than the turbine. Preliminary operation has provided opportunity to put into practice an instruction program that the operating personnel completed before the equipment was ready for service.

The station coal-handling system has been modernized to have a capacity of 800 tons per hr, ample to serve both present and proposed units at Fisk. Normal supply is received by barge, unloaded by a traveling tower crane,



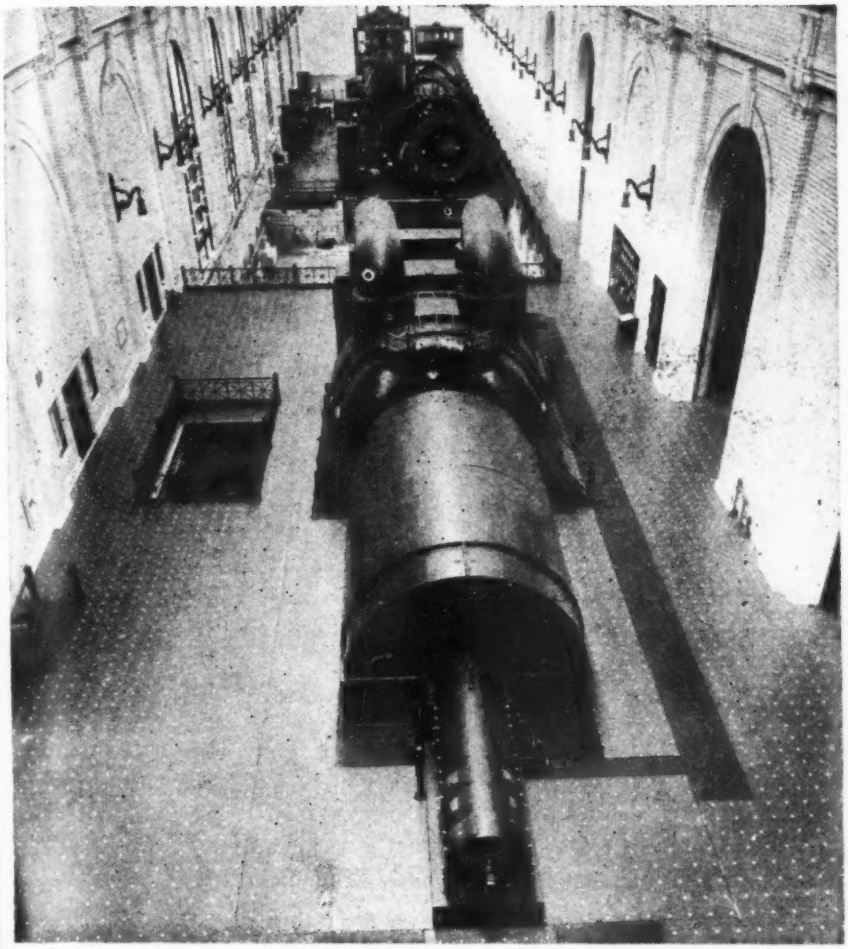


Fig. 1—New 147,000-kw turbine-generator, largest installed in this country since Pearl Harbor, occupies space provided by removal of three vertical units

crushed to 1¼-in.-minus size by two 500-ton-per-hr breakers, and transferred to the boiler bunkers by belt conveyors. Alternate coal supply may be received by rail, unloaded by a 20-car-per-hr rotary dumper.

Coal for unit 17 is transferred to 1000-ton bunkers, one for each boiler. From here it flows to three 17.5-ton-per-hr bowl mills and, after pulverization to 70% through 200 mesh, is fed to the furnaces by twelve multi-tip intertube pulverized-coal burners disposed across the top of each primary furnace.

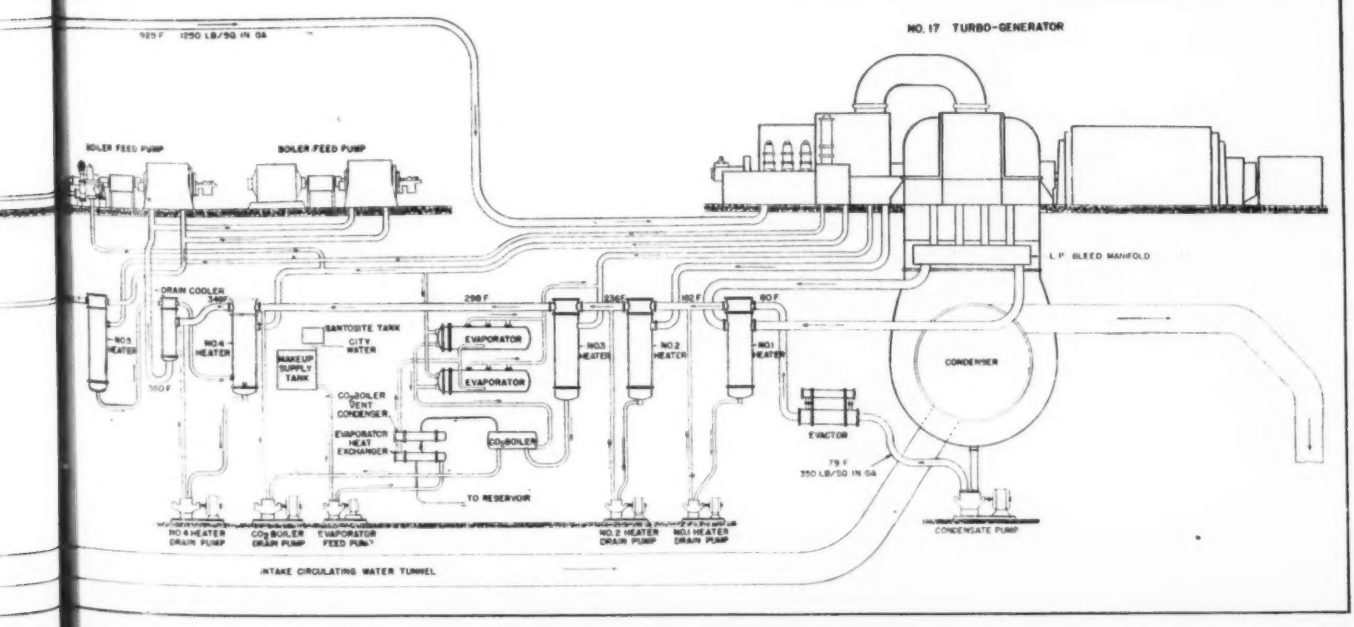
Fuel is Central Illinois coal, which has an ash content of approximately 14%. Located in the gas duct between air heaters and induced-draft fans are electric precipitators, one for each boiler unit. They collect 90% of the flyash before it discharges to the stack.

Flyash is removed periodically by a "hydrovac" dust system from the 16 hoppers under each precipitator, and transported to a vacuum dust-collector, from which it passes continuously to a 500-ton dust-storage bin by means of a vacuum-sealing dust feeder. Dust from the overhead storage bin flows through a mixer and unloader, where water is added to produce a commercially dustless mixture, to rail cars for disposal.

Melted ash (furnace slag) flows continuously from the furnace walls through two water-cooled slag holes in each primary-furnace floor to two water-filled slag tanks for each boiler. It is periodically sluiced to an outside pit.

The automatic boiler control system provides three conditions: full automatic, boiler manual, and hand. Under full-automatic, the system is actuated by changes in main-steam-header pressure through a master pressure element. With boiler-manual, regulators of either boiler may be directed by a single control element. Under hand-control, the regulators of each boiler may be positioned individually from the boiler board. Steam passing through and bypassing the attemperator is controlled only by a remote hand unit to regulate final steam temperature.

Efforts to attain simplicity have resulted in a reliable control system, al-



though the installation is complicated by the fact that two induced-draft fans, two forced-draft fans and three sets of mills and feeders per boiler may be operated in various combinations. The control system is arranged to accommodate these operating requirements.

The installation has four 600,000-lb-per-hr 1600-psi boiler-feed pumps: three are driven by constant-speed 1750-hp 3570-rpm motors and one by a 1540-hp 3340-rpm turbine. Feed pressure is controlled manually from the motor-driven pumps by throttling pump discharge valves. Control with the turbine-driven pump is attained by regulating speed. Normally the turbine-driven pump is used as a spare.

Fig. 3 shows a cross-section of the high- and low-pressure elements of the 1250-psi 925-F 1800-rpm Allis-Chalmers tandem-compound Curtis-reaction condensing turbine unit. Throttle steam flow at full load is 1,262,000 lb per hr; condenser flow is 845,300 lb per hr.

Because of the large amount of steam required, the turbine has two steam chests, one on either side of the high-pressure cylinder. Mounted on each chest is a 14-in. throttle valve and three 12-in. admission valves. An equalizing line connects the two chests to balance flow at high loads. The turbine is designed for four valve points: two to the impulse stage, the third ahead of the reaction blading, and the fourth by-passing six reaction stages.

The blade-carrying portion of the high-pressure spindle is machined from a solid forging. A stub end is shrunk, keyed and bolted at the low-pressure end. Low-pressure spindle consists of a built-up welded assembly of forged-steel disks and two forged-steel shaft ends. This construction insures a sound structure in so large a spindle.

Fig. 2—Closeup of low-pressure double-flow element. Last stages have a top speed of 1135 fps and pass 845,300 lb per hr of steam to 90,000-sq-ft condenser

The 90,000-sq-ft welded-steel-shell radial-flow single-pass condenser has arsenical admiralty tubes. Circulating water is supplied by two 82,500-rpm 54-in. motor-driven vertical-shaft propeller pumps located in the station screen house. Three 5-stage motor-driven 1050-gpm pumps deliver condensate at approximately 350-psi pressure through the feedwater heating system to the boiler-feed-pump suction.

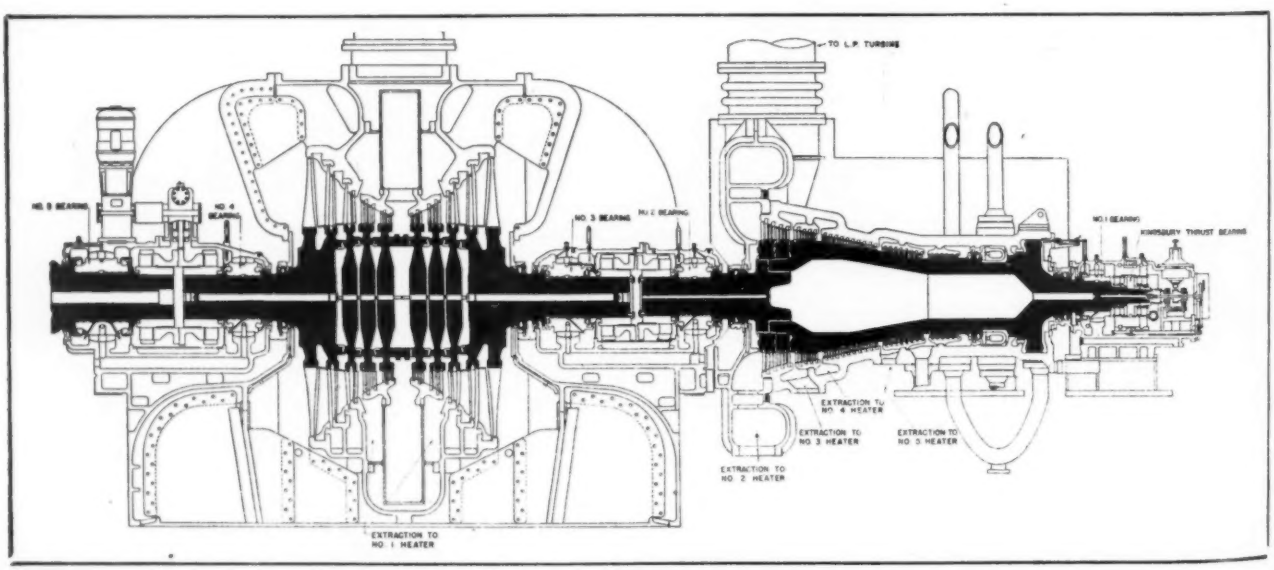

TO L.P. TURBINE
NO. 3 BEARING
NO. 2 BEARING
NO. 1 BEARING
KINGSBURY THRUST BEARING
EXTRACTION TO NO. 4 HEATER
EXTRACTION TO NO. 3 HEATER
EXTRACTION TO NO. 5 HEATER
EXTRACTION TO NO. 2 HEATER
EXTRACTION TO NO. 1 HEATER

Fig. 3—Cross-section of turbine illustrates built-up construction of low-pressure rotor. From twin steam chests steam flows through one Curtis and 39 reaction stages. High pressure casing has three bleed points, crossover one and low-pressure one

Principal New Power Plant Equipment—Fisk Station Unit No. 17

Steam Generating Equipment:

Boilers, two, 750,000 lb per hr.....Babcock & Wilcox Co
Heating surface: boiler 4954 sq ft, furnace to superheater 11,300, boiler and waterwall above superheater entrance 15,304, superheater 39,480, economiser 26,323, air heater 100,218, attemperator 2964. Furnace volume 116,000 cu ft. Maximum heat release 19,400 Btu per cu ft hr

Pulverized fuel equipment.....Combustion Engineering Co
Six 17.5 ton-per-hr Raymond bowl mills

Forced- and induced-draft fans.....B F Sturtevant Co
Four 167,000 cfm turbovane ID fans with dual-speed motors. High speed: 700 hp, 900 rpm, 2300 v. Low speed: 450 hp, 720 rpm. Four 96,000 cfm with dual-speed motors. High speed: 400 hp, 1200 rpm, 2300 v. Low speed: 225 hp, 900 rpm

Generating Equipment:

Turbine-generator .....Allis-Chalmers Mfg Co
147,000-kw 1800-rpm, 1250 psi, 925 F, 1-in. Hg. Two impulse rows and 39 reaction stages
147,000-kw 1800-rpm turbine, 1250 psi, 925 F, 1-in. Hg. Two impulse 0.8 pf, air cooled

Condenser, 90,000 sq ft.....Westinghouse Electric & Mfg Co
Single pass, radial flow

Condensate pumps.....Westinghouse Electric & Mfg Co
Three, 1050 gpm, 350 psi, 4 stage

Steam-jet air pumps, two 2-element, Westinghouse Electric & Mfg Co

Circulating-water pumps.....Worthington Pump & Mach Corp
Two, 82,500 gpm

Boiler-feed pumps.....Worthington Pump & Mach Corp
Four, 600,000 lb per hr, 1600 psi, 350 F. Three 1750-hp, 3750-rpm Westinghouse motors; one 1540-hp 3340-rpm Westinghouse turbine

Feedwater heaters and evaporator.....Griscom-Russell Co
No. 1 heater, 4280 sq ft, 4 pass; No. 2 heater, 3800 sq ft, 4 pass; No. 3 heater, 3755 sq ft, 4 pass; No. 4 heater, 4420 sq ft, 4 pass; No. 5 heater, 5020 sq ft, 2 pass. Drain cooler, 1170 sq ft, 1 pass. CO_2 boiler, 107,260 lb per hr with 85.7-sq-ft 4-pass vent condenser and 206-sq-ft 1-pass evaporator heat exchanger

Pumps .....Ingersoll-Rand Co
Two 100,000-lb-per-hr 360-psi No. 1 heater drain pumps; two 80,000-lb-per-hr 370-psi No. 2 heater drain pumps; two 125,000-lb-per-hr 350-psi CO_2 boiler drain pumps; two 235,000-lb-per-hr 385-psi No. 4 heater drain pumps; two 60,000-lb-per-hr 100-psi evaporator feed pumps

Electrical precipitators.....Research Corp
Two 75-kva 54-gas-duct Cottrell precipitators, ten 25-kva 440-v 75-kv transformers with mechanical rectifiers

Condensate is pumped, Fig. 4, from the deaerating storage hotwell at the bottom of the condenser through the five vertical heaters, a drain cooler, a CO_2 boiler, a vent condenser and a heat exchanger. Condensate is discharged at 350 psi from the hotwell pumps through No. 1, 2, 3 and 4 heaters and drain cooler to the suction header of the boiler-feed pumps. They discharge at 1600 psi through the No. 5 heater to the high-pressure feed header.

Heaters No. 1, 2 and 4 have drain pumps which discharge to the main feedwater line on the discharge side of the heater served. Drain from No. 3, which functions both as an extraction heater and evaporator condenser, passes through a drainer to the CO_2 boiler. A pump discharges the flow from the CO_2 boiler to the main feedwater line on the outlet side of No. 3 heater. High-pressure heater drains pass through coils of the drain cooler to the steam space of No. 4 heater.

Condensed steam from the evaporator coils passes through a drainer into the CO_2 boiler where it mixes with the drainage (evaporator distillate) of No. 3 heater. Condensed steam from the evaporator coils, being at a higher temperature than the drainage from the No. 3 heater, causes flashing in the CO_2 boiler, liberating dissolved gas from the makeup before it enters the feedwater stream. Vapor and gas driven off in the CO_2 boiler pass to the vent condenser, where the vapor is condensed by the raw water going to the evaporator and the free gas is vented to atmosphere.

The 147,000-kw 60-cycle 12,600-v 3-phase air-cooled generator has two electrically independent windings each of which connects to a separate bus system. Terminals of the two windings are brought out at opposite ends of the armature to relieve congestion of cables under the machine as much as possible.

Because of the large size of the field, its core is built up of a forged-steel shaft provided with axial, serrated grooves into which teeth are fitted to form the sides of the coil slots and the center of the poles. This construction avoids the extremely large forging that would be required if one-piece construction were used, as on smaller machines.

Turbine heat rate at full load is 8750 Btu per kwhr gross. Auxiliary power at full load amounts to about 7000 kw so that with boiler-room efficiency of 87% the over-all net heat rate is about 11,000 Btu per net kwhr.

Addition of unit 17 marks another important milestone in power-generation development of Fisk—earliest all-turbine station in America. This single machine with its two steam generators has more than twice the capacity of the 14 units and 112 boilers originally planned for the station. Compared with the original units on the basis of floor area occupied, the concentration of power is tenfold. Capacity per unit installed has been increased 30 times and performance improved 500%.

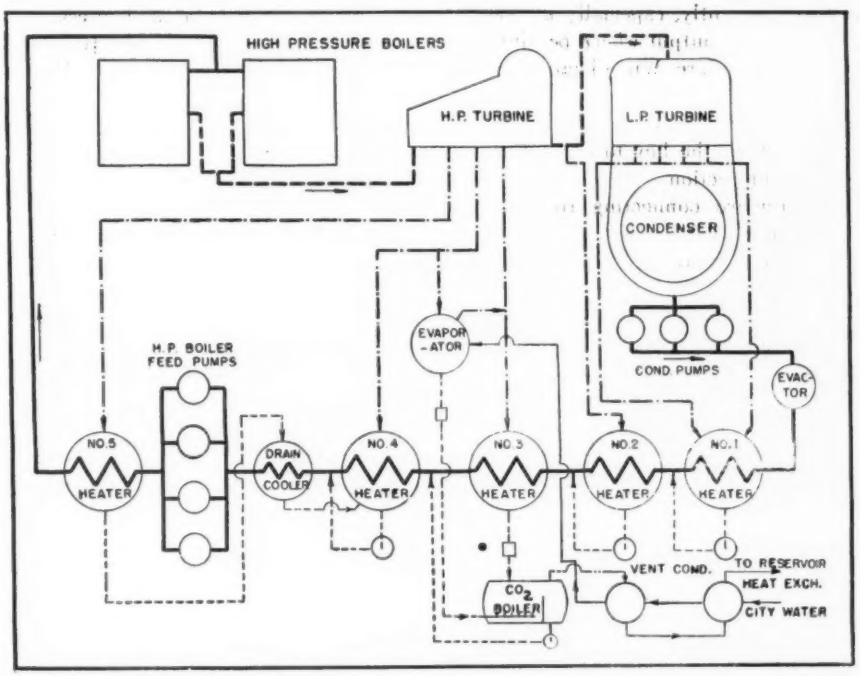
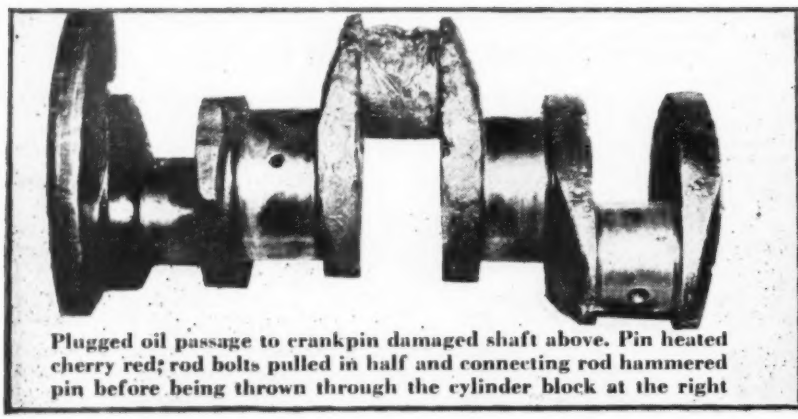
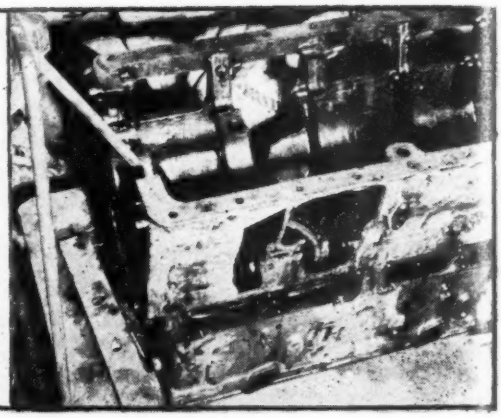


Fig. 4—Heat balance diagram shows schematic location of five stages of feedwater heating (to 455 F) evaporator and CO_2 boiler for evaporator condensate





Plugged oil passage to crankpin damaged shaft above. Pin heated cherry red; rod bolts pulled in half and connecting rod hammered pin before being thrown through the cylinder block at the right

How to Keep Diesel Crankshafts, Connecting Rods and Bearings in Trim

G H Menefee, chief machinist's mate, USNR, passes along some practical pointers for checking alignment of connecting rods and crankshafts, inspecting and adjusting engine bearings

► CRANKSHAFTS and connecting rods form the main moving parts of a diesel, and bearings serve as their support. Crankshaft and connecting-rod failures, fortunately, prove rare but such failures almost invariably wreck the engine. Bearing trouble, on the other hand, may occur frequently, especially in units of high specific output where bearing conditions are severe. When bearing failure occurs the watchful operator usually has adequate warning. As in all other phases of operation, the key to success lies in regular inspection and maintenance.

To remove connecting rods for inspection, take off the cover plates on the side of the crankcase and unbolt the connecting-rod bearing cap. In removing the bearing cap and inserts from the crankcase, use care to keep from dropping them in the pan. Remove the cylinder head and attach a lifting eye to the piston. Withdraw it part way, but slip a canvas or leather boot over the rod foot before it enters the cylinder to prevent scoring the walls. If there is no room for a boot, guide the rod through the cylinder with extreme care. After piston and rod are out of the cylinder, take out the wristpin to free the rod.

To check the connecting rod, replace the bearing cap and insert mandrels of proper size into both ends of the rod, as in Fig. 1. Measure the distance between mandrels on each side, as shown exaggerated in the figure, using inside micrometers. Distances should not differ by more than 0.003 in. per ft of length. Any greater deviation calls for a new rod or straightening of the old one. Usually straightening can be handled fairly easily in a small press.

Next check the rod for twist, as shown exaggerated in Fig. 2, by laying the mandrels on two straight edges placed edgeways on a surface plate. Space between mandrels and straight edges may be measured with feelers. Twist should not exceed 0.003 in. per ft of length. Connecting rods bent as in Fig. 3 are best checked by comparing a suspected rod with one known to be straight. This type of bend usually proves unimportant if the rod does not hit the cylinder-liner bottom when the engine turns over.

Inspecting Bearings

After the connecting rod has been checked for straightness, remove the mandrels and clean and inspect the bearings. Cleaning is best done by scrubbing with a medium-stiff fiber brush and a carbon solvent. Dark deposits on bearings may be either carbon and varnish or engine sludge, or they may be caused by corrosion, occasionally encountered with cadmium-nickel and copper-lead bearings. It pays to make sure whether such stains are caused by corrosion or are harmless deposits of dirty oil; many bearings are needlessly thrown away when they might well be put to further use. If you cannot remove stains by washing they are probably caused by corrosion, and the bearing should be discarded.

Bearings should also be checked for cracks and signs of overheating. Bright spots on the bearing inside indicate high places, which should be scraped down. Turning of the bearing on its seat causes bright spots on the back. If you find indication of turning, take steps to correct it because it will cause the bearing to burn out in short order.

Check bearing wear by measuring insert thickness if normal thickness is known or if there is a record of the thickness when installed. Maximum permissible wear may be taken as 0.0015 in. per in. of shaft diameter unless engine builder's instructions differ. Measure bearings with a micrometer that has a ball attachment. Precision bearings with excessive clearance must be discarded; adjust shimmed bearings by removing shims. Slight scores on bearings do not interfere with operation.

To remove main bearings for inspection, loosen screws of cap and remove it. Unless crankshaft is to be taken out

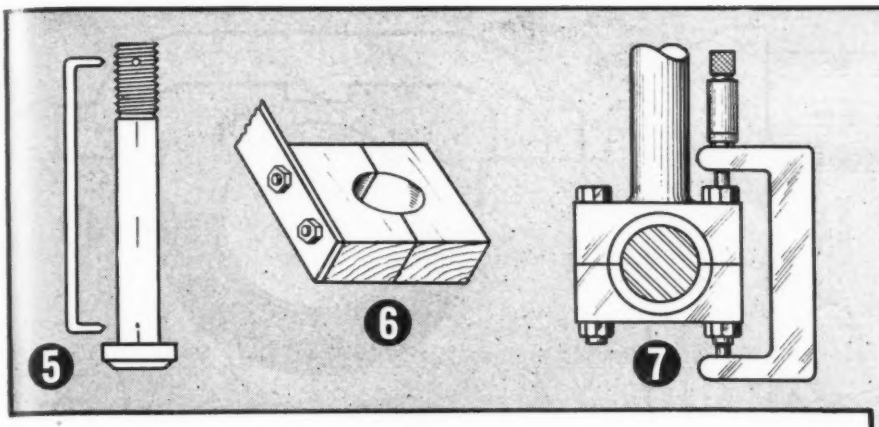


Fig. 5 (*left*) — Measuring connecting-rod bolts for elongation and twist. Fig. 6 — Wood-block device lined with emery cloth for smoothing scored journals. Fig. 7 — To set up connecting-rod bolts to proper tension, use micrometer to detect signs of elongation

remove bearings one at a time to avoid any chance of mixing them. To remove the bearing upper half, insert a pin into the oil hole so that it projects a distance less than the bearing-shell thickness. This is important, for if the pin projects too far it will damage the bearing seat. With the pin installed, turn the crankshaft slowly and the bearing shell will roll out. Most bearings may be rolled in one direction only; be sure to check this before attempting to remove the bearing. Inspect main bearings according to the procedure given for rod bearings.

Fig. 5 shows a method for discovering elongation or twist of connecting-rod bolts. Make three scribe marks along length of bolt before it is installed. When the bolt is removed for inspection, place a straight edge along the scribe marks. Twist should not exceed 3% of bolt length. At the time the scribe marks are put on the bolt, make two punch marks, as shown, and a tram to fit the two marks. The cotter-pin hole may be used in place of one of the marks if desired; countersinking the hole slightly to conform to the tram point protects the threads and increases measuring accuracy. Making the punch marks at the same distance on all bolts permits use of a single tram. Discard stretched bolts. If new bolts are not available, they may be machined from stock having at least 150,000-psi tensile strength. Mark nuts and bolts so that they are always used in the same pairs.

To take out the crankshaft, remove bearing caps after making sure that they are numbered so that you can reinstall them in the same order. Check to see on which side of cylinder block the numbers belong. Keep the inserts with the bearing caps and if the bearings have shims, tag them so you can reinstall them in the proper places, and adjust the bearing clearance without too much trouble.

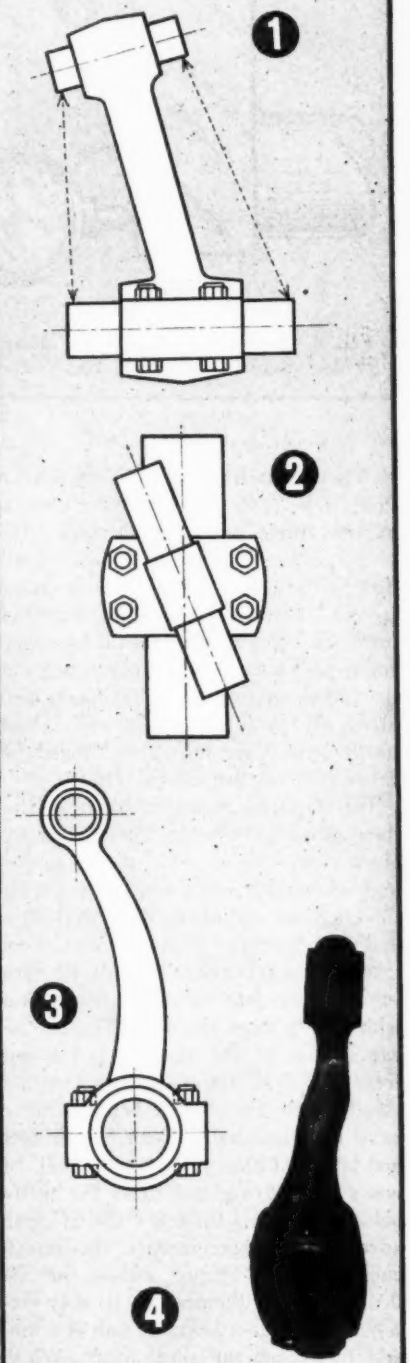
When you have removed the bearings, the crankshaft may be taken out for inspection. Wrap the crankpins near the shaft end with rags, tied on. Attach a rope sling to the cranks and lift the shaft carefully from its seat. Always use rope; wire or chain may damage even a protected shaft. Place the shaft out of the way and block it at several points to avoid any tendency to sag. Clean the shaft with a carbon solvent and wipe dry with clean rags. Blow out oil passages with air and, if necessary, shove a rag through the oil hole, but make sure that you remove all of the rag.

Inspect the shaft for scored crankpins and journals. Scores, if not too deep, may be removed by careful stoning. Stone across the entire pin face to keep pin from becoming egg shaped, and all the way around to keep it true. Clamping the fixture shown in Fig. 6 around the pin takes out deeper scores. A strip of fine emery cloth lines the fixture; keep it well oiled and oscillate the jig about the pin. If the crankshaft is too badly scored to repair by these methods, turn or grind it to 0.010 or 0.020 in. undersize. Engine builders manufacture inserts to fit these undersize pins. In marine installations possible difficulty in securing spare parts makes it advisable to turn all pins to the same size, instead of only the scored pins, or to build up damaged pins and grind to original size.

Check Shaft For Cracks

If counterbalances are bolted to the shaft, remove them and check the bolts for distortion or cracks. To check the shaft for cracks, dry it thoroughly and paint with a mixture of precipitated chalk and alcohol. If the shaft is bumped with a block of wood or rawhide mallet, oil from any cracks present will emerge and stain the chalk. Sometimes cracks may be repaired if an experienced welder does the work carefully. In small engines a new crankshaft usually proves cheaper and better.

(*Continued on page* 76)



(*Above*) Three types of connecting-rod misalignment, exaggerated for clarity. Fig. 1 — Lack of parallelism between wrist- and crankpins. Fig. 2 — Twisted connecting rod. Fig. 3 — Rod bent along its length. Fig. 4 — Actual rod showing all three misalignment types

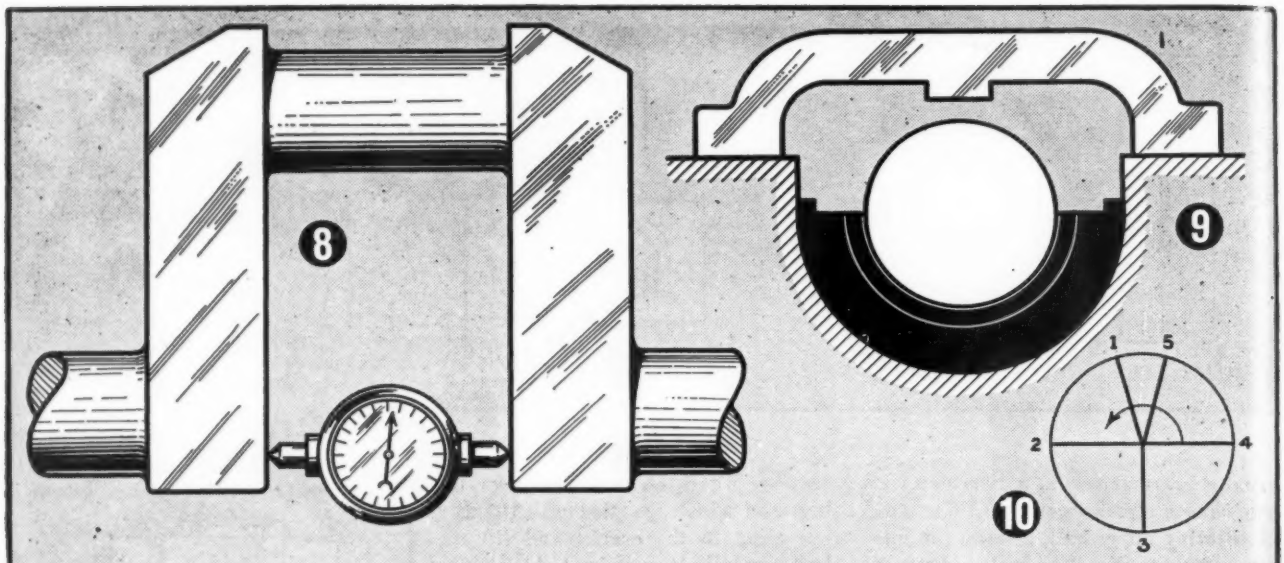


Fig. 8 — Checking crankshaft alignment by strain gage between webs. Fig. 9 — Shaft alignment is also determined by bridge gage and feelers. Fig. 10 — Take strain-gage readings at five points of normal shaft rotation, as diagrammed

When installing bearings in the engine, thoroughly clean bearing seats in engine frame and bearing caps. Also clean outside surfaces of the inserts; dirt on the outside causes just as much trouble as on the inside. Make sure that insert oil holes line up with those in the frame and that both are open. See that the dowel enters its hole properly and, above all, be sure that top and bottom insert halves are not interchanged because they are not always alike.

Place inserts in engine frame and oil them thoroughly before lowering crankshaft into place. Oil the journals, and lower shaft into the bearings evenly. Cocking one end of the shaft may damage it or bearings. Place the rest of the inserts in bearing caps and oil. Be careful to place caps in the position from which they were removed. Tighten the cap screws on the thrust bearing and force the shaft toward one end with a small pinch bar. Thrust-bearing clearance can then be measured with feelers. If thrust clearance is too small, remove the bearing and dress the thrust collar carefully with a fine file. If clearance is too large, replace the inserts containing the thrust collar, or the thrust collars themselves if they are separate. Tighten bearings one at a time and turn over the shaft after each is tightened. If the shaft is not free, remove the bearing and locate the cause.

Adjust bearing clearance according to manufacturer's instructions, if available; otherwise, give the bearing from 0.00075 to 0.001 in. per in. of shaft diameter. Leads may be taken to measure clearance but measuring insert thickness with a micrometer is a better method. When taking leads on a bearing, proceed as follows: Take small strands of lead wire and twist them into a strand slightly larger than estimated bearing clearance. Place it in the bearing shell perpendicular to the shaft axis. Leads should not extend to the bearing edge. On large bearings, take three or four leads along the length; they may be taken at the same time.

After placing leads in the bearing, bolt cap down tightly. Then remove cap and measure thickness of leads with a micrometer. Some manufacturers advise against taking leads because the bearing metal of their engines is too soft and the leads may groove the bearing.

If the bearing contains shims, remove or insert them to adjust clearance. They may be removed from one side at a time for fine adjustments but keep shim thickness on each side of the bearing as even as possible. If bearings do not have shims, the bearing insert must be replaced if clearance is too great. If it is too small, bearings may be line bored if equipment is available. In lieu of this, turn a mandrel to exact shaft diameter and coat it with fine grinding compound. Rotate the bearing around the mandrel until it is ground to proper size. Take care not to give the bearing too much clearance; compound cuts quickly.

Reassembling Rods

After the crankshaft is installed, tighten main-bearing cap screws and lock bolts with binding wire, making sure it does not project into the connecting-rod path. Lower the connecting rod onto the crankpin, taking care that the rod does not score the shaft. Coat the crankpin with oil before the rod is seated. Then place bearing cap on rod and tighten bolts. Use a torque wrench and tighten to the tension the manufacturer recommends. If there are no tension data, tighten bolts until they begin to stretch as measured by a micrometer, Fig. 7.

Test crankshaft alignment with a bridge gage, as follows: Remove cap from one main bearing and hold crankshaft down into adjacent bearings by a jack on the crank webs. Seat the bridge gage over the frame, as in Fig. 9, and measure clearance between gage and journal with feelers. Crankshaft should not be out by more than 0.0015 in.

Use of a strain gage often proves an easier method of checking alignment. Any misalignment shown by the strain gage should be checked with the bridge gage. To take strain-gage readings, make center punch marks in the crankweb as far as possible from the pin, that is, about ¼ in. from the web edge. Set the piston on bottom dead center, leaving just enough room to insert the gage so that it will not hit the connecting rod. Keep enough tension on the strain gage to deflect the needle about 0.030 in. This should be enough to hold the gage in position, Fig. 8, and to allow for any negative readings. Rotate the shaft in normal operating direction and away from the gage. At the five points of Fig. 10, take readings: They should not show any marked difference and should change progressively. If readings taken in positions 1 and 5 are not the same, take them again. If deflection is greater than 0.0015 in., check the shaft with the bridge gage.

Continuous-Flow Conveyor Elevators Streamline Materials Handling

Wilbur G Hudson, materials-handling engineer, compares the structural features of four systems of continuous-flow conveyor elevators used in this country, gives their advantages for handling granular and pulverized materials, and outlines some of their limitations

▶ ABOUT 40 YEARS AGO an English miller named Redler made a grain-handling conveyor that used a new materials-handling principle. He discovered that skeleton flights, similar to Fig. 2, attached to an endless steel cable and pulled through a continuous mass of grain in a square duct, cause the grain to flow in either a horizontal or a vertical direction. Movement continues because the force necessary to overcome friction of material against duct walls is less than that to pull flights through material. Several designs of this continuous-flow conveyor elevator (sometimes called *en masse* conveyor) are built and used in this country extensively.

Several years ago, Stephens Adamson Mfg Co began the manufacture here of an improved Redler conveyor. They replaced the steel cable with a detachable malleable-iron or alloy-steel chain, with a flight cast integral with each link, Fig. 2. This construction conforms better to American practice and adapts the conveyor to a wide range of granular and pulverized materials, including coal.

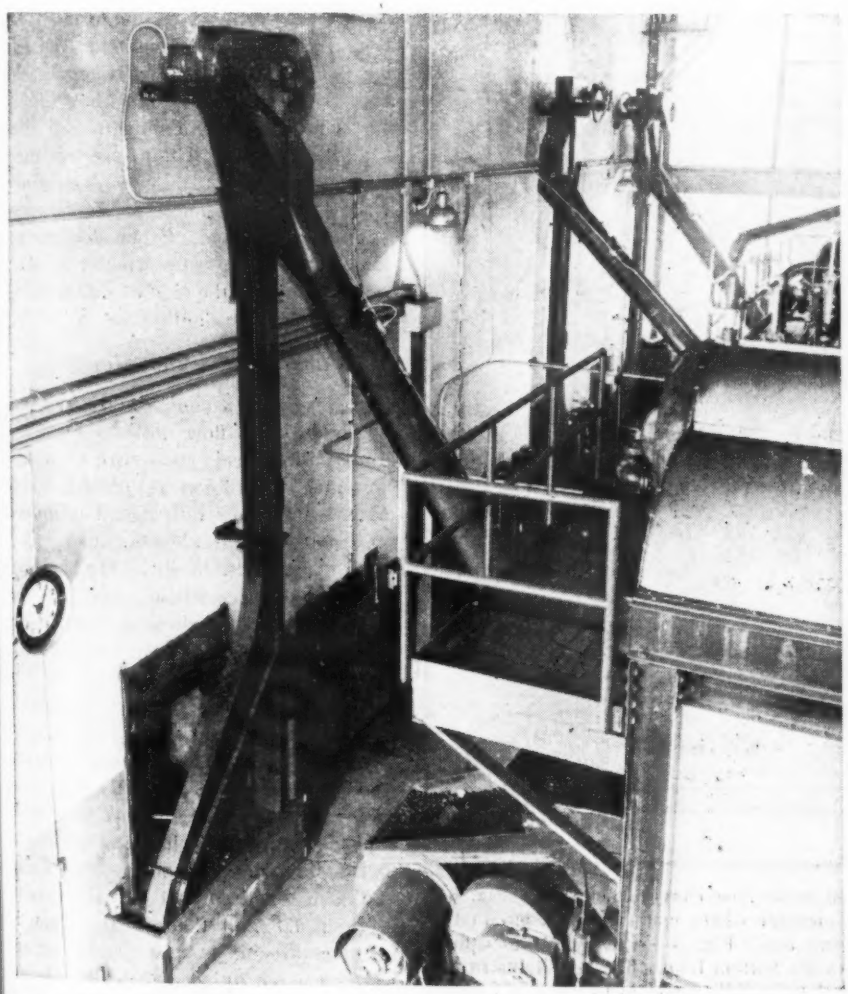


Fig. 1—These continuous-flow conveyor elevators, under automatic control, take coal as it flows from the storage-bin door and deliver it to the stoker hoppers.

Fig. 3 shows arrangement of a Redler conveyor. Material fed to the top run is carried backward, discharged on the bottom run, and drawn forward in a continuous stream up the vertical leg to the discharge. The chain has self-cleaning open joints with ample bearing surface to carry rated load and to prevent galling. U-flights project inward and thus straddle head and tail sprockets to reduce terminal housing size. At discharge, material flows outward as flights emerge from the duct. For sluggish material, a push-out plate *P*, located between the flight prongs above the discharge chute, assists discharge.

Fig. 2 shows standard flights, which are made in several forms for special applications, as for a round duct. Theoretically the continuous-flow conveyor elevator may have almost any capacity, but usual maximum is about 200 tons per hour.

Another machine, Bulk-Flo, of the Link-Belt Co, has a detachable chain with an attachment at each link, to which a flight is bolted. Flights are inverted V in shape, Fig. 4 to 6, unless conveyor operates horizontally or nearly so, when they are flat, sloping slightly rearward, as in a scraper-flight conveyor.

In vertical runs, material discharges outward as flights emerge from the duct, Fig. 4, except a small residue, which spills rearward as flights round the head sprocket and is deflected around the main flow by an inverted-V deflector. Load reaction on each flight tends to thrust the chain against the partition plate in a vertical run. To counteract this thrust, outer leg *A*, Fig. 5, is shorter than inner leg, *B*, so there

is a counteracting outward thrust away from the partition plate.

Chain pins lock in link bar ends, *C*, Fig. 5 and 6, by a projection which fits in a recess. Thus, articulation is in forked-end *F*, which has twice the bearing area of *C*. To disconnect the chain, a link is swung backward until the projection on the pin registers with an offset recess in the forked end.

Mass-Flo conveyor, Fig. 7 and 7*a*, of the Jeffrey Mfg Co, has a chain quite similar to that just described, but with a short projecting arm on alternate links on which a traylike flight pivots, Fig. 8. In a vertical run as the flights emerge from the duct, each unit load flows out, assisted by tilting of the flights by a stationary cam *C*, Fig. 7. A small projection on the flight prevents upending as it rounds the head or tail sprocket. On a horizontal, or flat-inclined conveyor, flights are not pivoted but function like a scraper conveyor.

Uni-Flo, of the Chain Belt Co, another continuous-flow conveyor elevator has projecting arm *A*, Fig. 9, on alternate chain links on which flight *F* rests and is pivoted to its outer end at *B*. As flights emerge from their casing, unloading is assisted by a synchronized chain-driven cam, which tips the flight steeply forward as at *F*, Fig. 10.

A recent patent, issued to W H Thoma, shows a continuous-flow conveyor elevator, Fig. 11, with slightly curved flights attached to link-side-bar cantilever extensions. As each flight rounds the head sheave it takes a circumferential position to pass edgewise through a narrow slot, and discharges material too sluggish for gravity flow.

Continuous-flow conveyor elevators are suited to a wide variety of materials in many industries. Manufacturers list over 200 materials in 50 industries that have been so handled. They have the advantage of conveying horizontally, vertically, or on incline or around curves. Their slow speed and inherent easy action on material conveyed reduce breakage to a minimum. Dust tight from intake to discharge, they can be fed direct from the bottom of a pile of material without a feeder. Because of this self-feeding characteristic they are easily loaded on their horizontal run, Fig. 3, or base loop, Fig. 6, without a deep pit, requiring only space for the material to flow in by gravity. They can be designed and installed to feed and discharge at several points between tail and head sprocket.

Fig. 3 shows the usual feed arrangement, as from a track hopper. Material enters the return conveyor run, passes rearward a few feet and flows down into the carrier run. Some materials that are extremely free flowing, such as soda ash or salt cake, tend to pack in the duct by gravity flow. In the Redler, this is prevented by a short-trough filler straddled by the flight prongs on their feeding run. Size of filler is determined by how much it is necessary to decrease loading percentage. Other designs reduce the loading rate when necessary by feeding in at the side of the carrying run at a suitable depth.

Continuous-Flow Elevator

Fig. 4 shows a common arrangement of a continuous-flow unit for elevating only. Here feed goes direct to the carrying run. Loop is placed where material can flow into it and is picked up directly by the elevating run.

An example is shown in Fig. 1 where three elevators deliver coal to the stoker hoppers of three boilers. Coal flows from storage bin to loops and is elevated to chutes leading to the stokers. Control is fully automatic, starting delivery to stoker hoppers when they are nearly empty and stopping when they are full.

Theoretically a conveyor elevator's capacity is the net volume swept by the flights, but there is some backward slip of the material so that actual capacity is about 80% of theoretical. Thus, if net duct area is 1 sq ft (cross-section less space occupied by the conveying element) and the speed 50 ft per min, conveyor capacity is about 1x50x0.8=

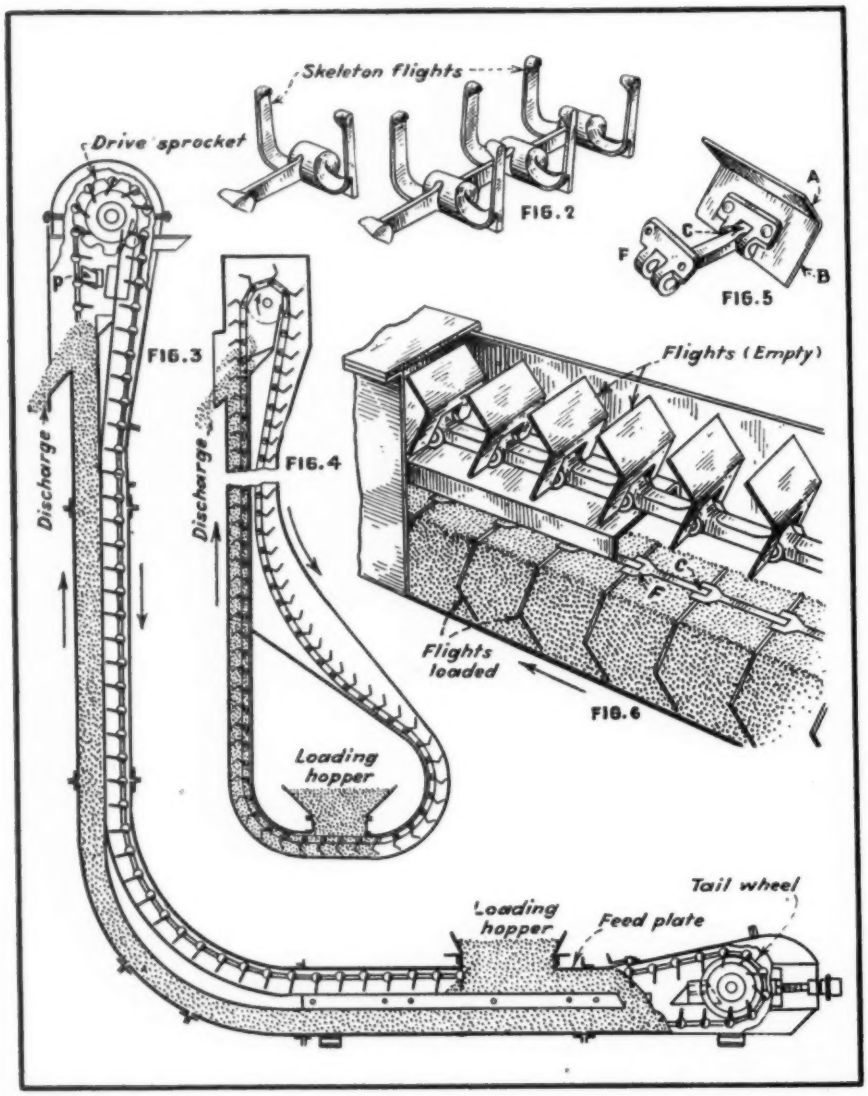


Fig. 2—Skeleton flights are used in the continuous-flow conveyor elevator (Fig. 3). Fig. 3—General arrangement of a conveyor elevator where material is loaded in the horizontal run and discharges near elevator top. Fig. 4—When continuous-flow machines elevate only, loading is directly into the bottom loop. Fig. 5—Flights in the conveyor elevator (Fig. 4) are peaked steel plates rigidly attached to the chain links. Fig. 6—Loaded and unloaded strands of a conveyor elevator can operate close together, with only a thin-plate division between the carrying and unloaded runs

40 cu ft per min. When coal is handled, this is about 60 tons per hr.

Since the material handled is in sliding contact with the duct walls, driving-motor horsepower depends on conveyor capacity and coefficient of friction of the material against steel plate. Obviously, a conveyor elevator requires more power than a bucket elevator of equal capacity, but since it eliminates a feeder its cost usually is less than a steel-incased bucket elevator, with apron or reciprocating feeder. It may not cost less than a simple centrifugal-discharge-bucket elevator with a screw feeder driven from the elevator foot shaft, but slow speed of the conveyor elevator is generally preferred to high speed of the bucket elevator. A continuous-flow conveyor elevator costs about twice as much as a steel-flight screw conveyor, and about the same as a scraper flight conveyor with housing.

Continuous-flow conveyor elevators are essentially slow-speed machines, a speed not in excess of 70 ft per min being advisable, with 50 ft per min preferred, compared to 250 ft per min for a centrifugal-discharge bucket elevator

Continuous-flow conveyor elevators, when gravity loaded to capacity, require more power than a scraper-flight conveyor since material in the former is in sliding contact with at least three walls of the duct. However, if not jam loaded its driving power about equals that for a flight conveyor of equal capacity.

Though continuous-flow conveyor elevators have been uniformly successful in the past few years, they are not the answer to all materials-handling problems. They are unsuited to some materials and to some conveying and elevating paths. Material with hard lumps, like gravel and crushed stone, are handled better by a belt conveyor, bucket elevator or skip hoist. Corrosive or abrasive materials, like wet ashes or damp high-sulphur coal, should be handled by a cast-flight screw conveyor, a drag-chain conveyor or a skip hoist, and not a conveyor elevator.

When the horizontal run is more than 25 ft, followed by a vertical lift, it is better to use a conveyor and elevator in tandem to eliminate excessive thrust and wear at the upturn. An idler drum can be installed at the upturn to take the thrust, but a separate conveyor and elevator in tandem is still generally preferable. Where a vertical run is followed by an upper horizontal run, it is better practice to use tandem units for many applications.

Where materials must not be exposed to outside contamination or lubricants, conveyor elevators have decided advantages. If materials must be maintained at practically constant temperature, as in processing operations, conveyor-elevator duct may be insulated against heat radiation.

Small space requirements, about one sixth that of a bucket elevator of equal capacity, permit installing a conveyor elevator where there is not sufficient space for a bucket elevator or a flight conveyor. Its box casing is self-supporting and often eliminates bridge or tower structure necessary for other types of conveyors and elevators. As a rule continuous-flow conveyor elevators are of medium capacity, but the trend is toward larger installations with suitable protection against abrasion.

POWER Shortage

Because paper is critically short, POWER's circulation is unavoidably frozen at present levels. That's why over 2000 engineers who want to subscribe cannot be served—are on the waiting list. Subscribers coming up for renewal don't have to wait if they get their orders in promptly. But if they let their subscriptions lapse, it takes one to three months to get back on the lists—and generally there is no way to buy, borrow, beg or steal numbers missed.

To insure unbroken service and protect yourself from inconvenience, the editors urge you to renew promptly on receipt of first notice.

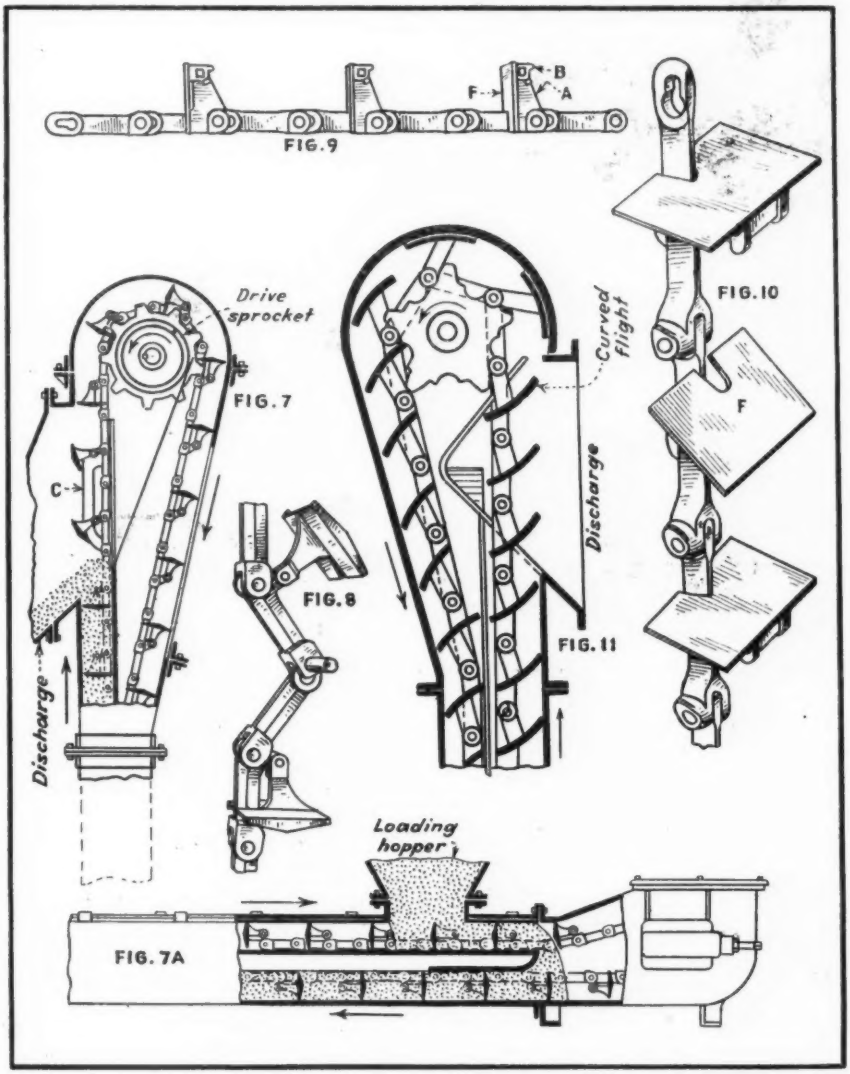
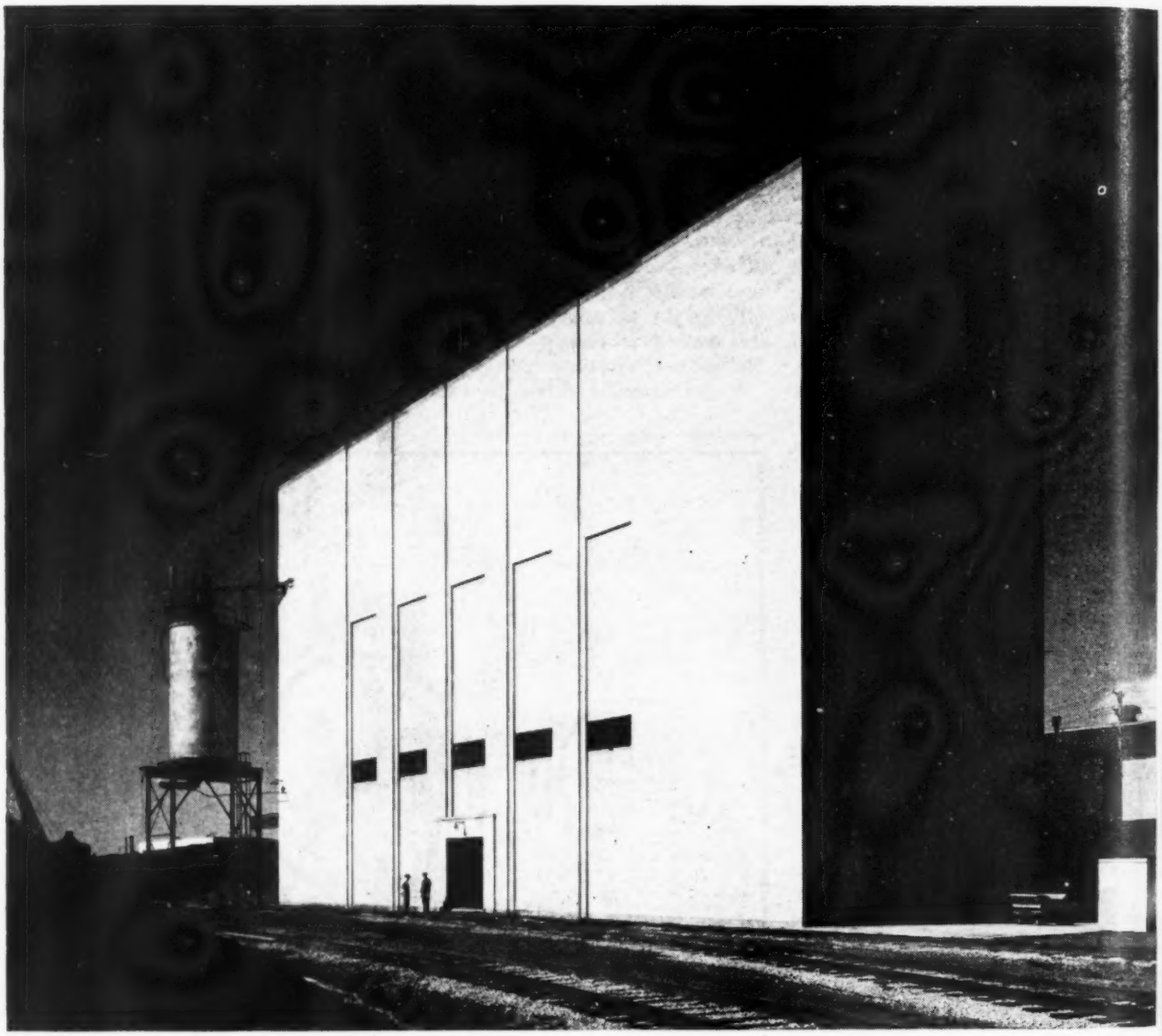


Fig. 7 and 7a—Loading and discharge ends of a continuous-flow conveyor elevator that uses flat flights hinged to the conveying chain. Fig. 8—Chain section with flights for the conveyor (Fig. 7). Fig. 9—Chain section and flights for a conveyor elevator that has pivoted flights on alternate chain links. Fig. 10—Flights (Fig. 9) are hinged to the outer end of arms and tipped forward, as at *F*, to assist unloading. Fig. 11—Discharge end of a continuous-flow conveyor elevator that has slightly curved flights, which pass through two slots when discharging material, to assist unloading

WINDOWLESS BOILERHOUSE



Note light-tight air inlet louvers in the windowless building. Steam conveying system delivers ash to tank over track at left

By C A SPRINGER
Mechanical Engineer, Albert Kahn Associated Architects & Engineers, Inc

The four 100,000-lb-per-hr boilers have continuous ash-discharge spreader stokers. Steam-main storage protects reducing valves from steam-hammer pulsations

▶ THE CHEVROLET aluminum forge plant at Saginaw, Mich., built with Defense Plant Corporation financing for operation by Chevrolet division of General Motors, turns out aluminum forgings for airplane parts such as landing gears, and for engine parts such as crankcase housings for Pratt & Whitney engines, with bulk of the output solid aluminum propeller blades of various sizes. Originally the plant was scheduled to produce almost four million pounds of aluminum forgings a month, but the operators have nearly doubled this figure with only incidental additional equipment.

Designed to operate in complete blackout for wartime security, the boilerhouse serving this war plant is windowless. Light-trapping inlet louvers and roof ventilators provide ventilation. The louvers also supply large amounts of air for combustion, a total of about 200 tons per hour when boilers are operating at full load. Like all Kahn-designed boilerhouses, it is completely automatic.

Four 4-drum bent-tube boilers, with sectionally supported air-cooled settings, supply steam for steam hammers, process work and space heating. Designed for 200 psi, boilers operate at 175 psi, no superheat. Each boiler can produce 100,000 lb of steam per hour with a higher peak possible for shorter periods. Boilers are fired by spreader stokers with traveling-grate continuous ash discharge.

A steam-operated pneumatic ash conveyor delivers ashes and soot to a storage tank over a railroad siding for direct spouting to railway cars.

Brought in by railway cars, crushed and screened coal is elevated and distributed to an overhead reinforced con-

SERVES CHEVROLET FORGE PLANT

Three of four 100,000-lb-per-hr 200-psi boilers equipped with continuous-discharge spreader stokers and automatic control

Principal New Power Equipment

Boilers, four, 100,000 lb per hr	Wickes Boiler Co
Stokers, continuous discharge, spreader	Detroit Stoker Co
Settings, air cooled	Bigelow-Liptak Corp
Soot blowers	Diamond Power Specialty Corp
Induced-draft fans, cinder catching	Buffalo Forge Co
Forced-draft fans	Buffalo Forge Co
Ash-handling equipment	United Conveyor Corp
Coal-handling equipment	Fairfield Engineering Co
Hot process water softener, with deaerating heater and pressure filters	Worthington Pump & Machinery Corp
Internal boiler treatment	Worthington Pump & Machinery Corp
Air compressors	Worthington Pump & Machinery Corp
Boiler-feed pumps	DeLaval Steam Turbine Co, American-Marsh Pumps, Inc
Continuous blowdown system	Cochrane Corp
Blowoff valves, Yarway	Yarnall-Waring Co
High-pressure valves, steam	Jenkins Bros
Combustion control, with meters and draft gages	Republic Flow Meters Co
Pressure-reducing valves	Spence Engineering Co
Induced-draft-fan turbines	Elliott Co
Forced-draft fan turbines	Elliott Co
Boiler-feed-pump turbines	DeLaval Steam Turbine Co
Stoker-fan turbines	Carling Turbine Blower Co
Induced-draft-fan motors	Louis Allis Co
Forced-draft-fan motors	Westinghouse Electric & Mfg Co
Stoker motors, Delco	General Motors Corp
Air-compressor motors	Westinghouse Electric & Mfg Co
Boiler-feed-pump motors	Westinghouse Electric & Mfg Co
General contractor	Christman Co
Designers	Albert Kahn Associated Architects & Engineers

crete bunker by apron feeder, bucket elevator and belt conveyor. From the bunker it is conveyed, weighed and distributed to the several stoker hoppers by a motor-driven weigh larry.

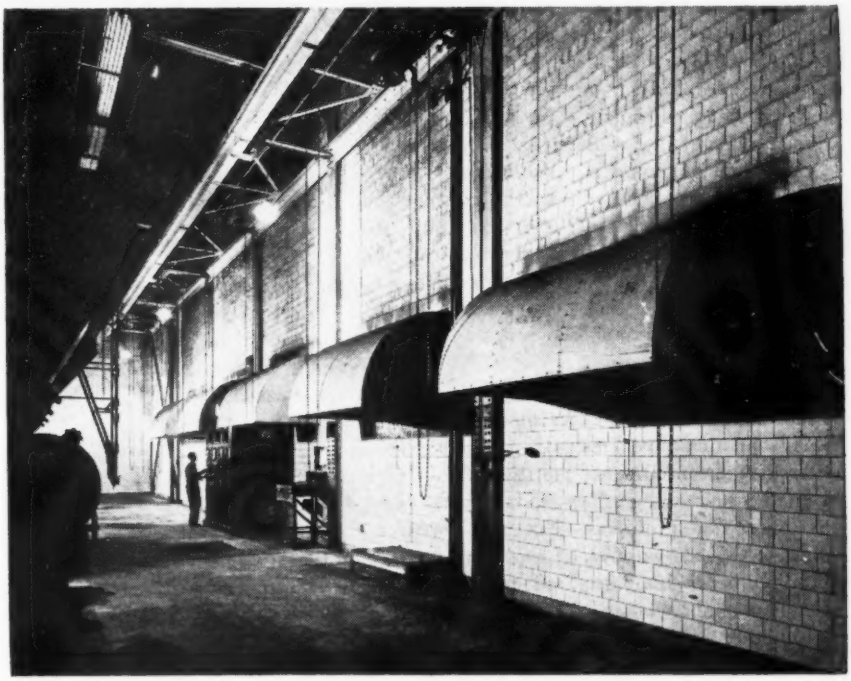
After boiler feedwater is deaerated, heated and treated in a combination heater and hot-process softener, it passes through pressure filters packed with anthracite filling material. Supplemental phosphate treatment is pumped directly to each boiler.

Of three 350-gpm centrifugal boiler-feed pumps, two are steam turbine driven and one motor driven. A 75-gpm duplex steam pump supplies feedwater at low loads.

Induced- and forced-draft fans are dual driven by steam turbine and electric motor. The induced-draft fans (cinder-catching type with cinders returned to the furnace) are mounted behind and above the boilers. The forced-draft fans are on the operating floor at rear of boilers. Equipment includes complete automatic combustion control and CO_2 recorders.

As the entire building is of blackout construction, ventilation for reasonable comfort and admission of combustion air were important problems of boilerhouse design. In the walls are louvers, and in the roof, extra-large blackout ventilators with motor-driven exhaust fans, in addition to gravity ventilators.

The concrete hotwell, receiving condensate from the foundry and heating drips, provides reservoir for boiler feedwater. Summer makeup approaches 100%, requiring large-scale treatment.



East wall of boiler room showing light-tight vent louvers admitting combustion and ventilating air to boiler room. Motor-driven exhaust fans are located in roof

Leaving the boilers at 175 psi, steam is reduced to 120 psi before leaving the boilerhouse, instead of being reduced to the required 100 psi in the foundry. This arrangement provides a steam reservoir in the large main to dampen the rapid demand fluctuations set up by steam hammers in the forge shop. Reducing valves do not function properly on rapid and widely fluctuating loads unless there is a relatively large reservoir to cushion load demand at the reducing valve location.

Proper Materials and Methods Make Power-Plant Cleaning Jobs Easy

Keeping equipment clean inside and out maintains efficiency and capacity, helps to insure reliability. This article, first of two, shows how to fit the cleaning compound to the job and gives practical pointers on methods

By Dr R W MITCHELL *Technical Director, Magnus Chemical Co, Garwood, N. J.*

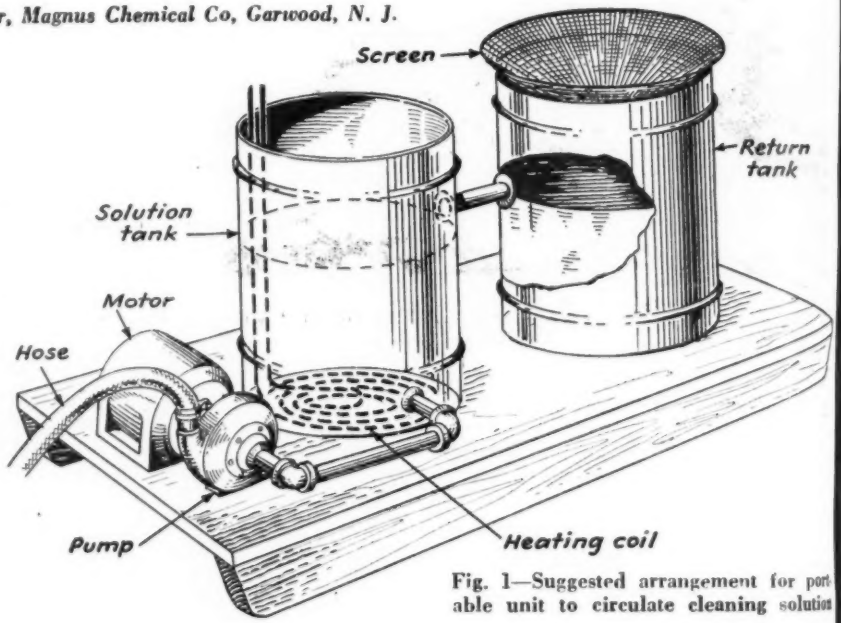


Fig. 1—Suggested arrangement for portable unit to circulate cleaning solution

► BACK OF THE ENTIRE WAR PROGRAM stands the power plant. For whether it is steam, diesel or hydro, central station or industrial, it keeps the production machine's wheels turning. That's a big job with plenty of oversized headaches for those responsible for uninterrupted power output. Thus, it might seem that a discussion of power-plant cleaning problems, being apparently a minor headache, puts undue prominence on a rather unimportant subject.

But the fact is that the majority of cleaning problems faced by the power engineer are directly concerned with the steady supply of power. If heat exchangers accumulate scale and muck to the extent of impairing effective heat transfer, power output suffers. If sludge deposits build up in fuel-oil tanks to a point where screens clog badly, burners must be shut down for cleaning, while boilers limp along at reduced output.

Plant-Cleaning Problems

The power engineer faces many and varied cleaning problems, all of which deserve the intelligent consideration given to other and perhaps more obvious operating problems. Not all involve the steady supply of power but all, directly or indirectly, affect plant efficiency and economy. This article and another to follow consider the various cleaning operations in the average plant. They indicate developments in recent years in cleaning materials, and suggest methods that may be new to many power engineers even though proved by experience in a large number of plants.

Before going into cleaning operations in detail, it is well to take a look at certain common requirements for cleaning materials. Particularly is this important in power-plant work because the nature of scales and dirts to be removed often seems to call for a strong cleaner. Unless the cleaning operation's nature is thoroughly understood, hazardous materials are employed in the mistaken belief that a tough job requires a strong cleaner and that the operator must, of necessity, face the risks involved. Here are factors to consider in selecting cleaners: 1. *Cleaning material should be safe to handle and use.* Many cleaners find use today because of mistaken ideas of the strength and efficacy of caustics. The fact is that at best caustics are not very good cleaners; they show poor wetting and penetrating action. prove extremely difficult to rinse off and are hazardous to handle and use.

High alkalinity proves necessary for some cleaning operations, but materials far less hazardous than caustics will do the job; while handling precautions are necessary, danger is greatly reduced. Experience indicates that proper selection of ingredients usually makes it possible to produce a cleaner that does the work better and rinses off much more quickly and thoroughly than a caustic material.

Some Solvents Dangerous

Dangers of volatile solvents, such as gasoline and benzine, should need no emphasis in the power-plant field but deserve mention here because fire and explosion records of insurance companies show that their use remains too prevalent in industry as a whole.

2. *Cleaners should have no harmful effects on equipment or surroundings.* This provision appears to need little elaboration. Yet many a concrete floor is being cleaned today with materials that cut deeply into its service life. Many materials capable of doing a good cleaning job also tend to attack metals of equipment being cleaned. Range of products available for any particular power-plant scale- or dirt-removing job usually make it possible to choose one that cleans thoroughly without harmful effect on metal or any other material

with which it comes in contact during operation.

Where nature of the scale or dirt to be removed dictates a cleaner that can attack equipment or surroundings, there is usually considerable latitude of choice so that careful selection will find a compound having minimum harmful effect. Where harmful action may take place, the operator must control the procedure more rigidly than with harmless or relatively harmless cleaners.

3. *Cleaning method should be simple and involve minimum technical supervision.* Like any other maintenance job, cleaning should be made as easy as possible so that as the job routine is established carelessness will not lead to omission of important steps. The simpler the cleaning process, the surer you are that you will obtain the desired result, particularly in these days when manpower shortages make it difficult to hold skilled personnel.

The same holds good for supervision and control. If choice of one cleaner over another makes it possible to avoid technical supervision a substantial gain results, not only in over-all savings but in the opportunity to put that particular operation on the list of routine operations that need not be delayed for inspection or tests.

4. *Cleaning method should be as speedy as possible.* When the value of operating time, as well as shutdown cost is considered, this factor becomes obvious. If one cleaner works twice as fast as another and involves less time for rinsing and after-treatment, its use will pay dividends even when, as might well prove the case, cost per pound runs higher than for a slower cleaner.

But even where the main consideration is avoiding shutdowns or holding production equipment out of service, many other good reasons exist for cleaning speed. In these days of acute labor shortage one man may well have to do the work of two, or even three when it comes to the cleaning phase of a maintenance job. In fact, this is as good a time as any to point out that one of the greatest fallacies in choosing a cleaning compound is the far too common practice of judging it on the basis of relative cost per pound.

There is only one sound way to compare cleaners. What is the cost, the *over-all* cost, of cleaning per square foot for each of the compounds under consideration? A cleaner costing twice as much per pound as another can, and often does, clean so many more square feet of surface or so many more units per pound consumed that it proves far and away the most economical. And as labor time becomes more and more a factor, cleaning speed assumes greater and greater importance in cost comparisons.

5. *Cleaning costs must be held to a minimum.* Following through on the above thought, and dealing first with cleaning operations that are unquestionably essential, it seems only common sense to study materials and methods until a combination is found that costs least for results wanted on a routine basis.

Furthermore, a number of cleaning jobs in any plant are probably not regarded as essential because the plus values they might yield are intangible or difficult to justify on a cost basis. When cost comes down, many such operations become definitely worthwhile. Properly selected cleaners, fitted to the job, usually cut cleaning costs by large amounts.

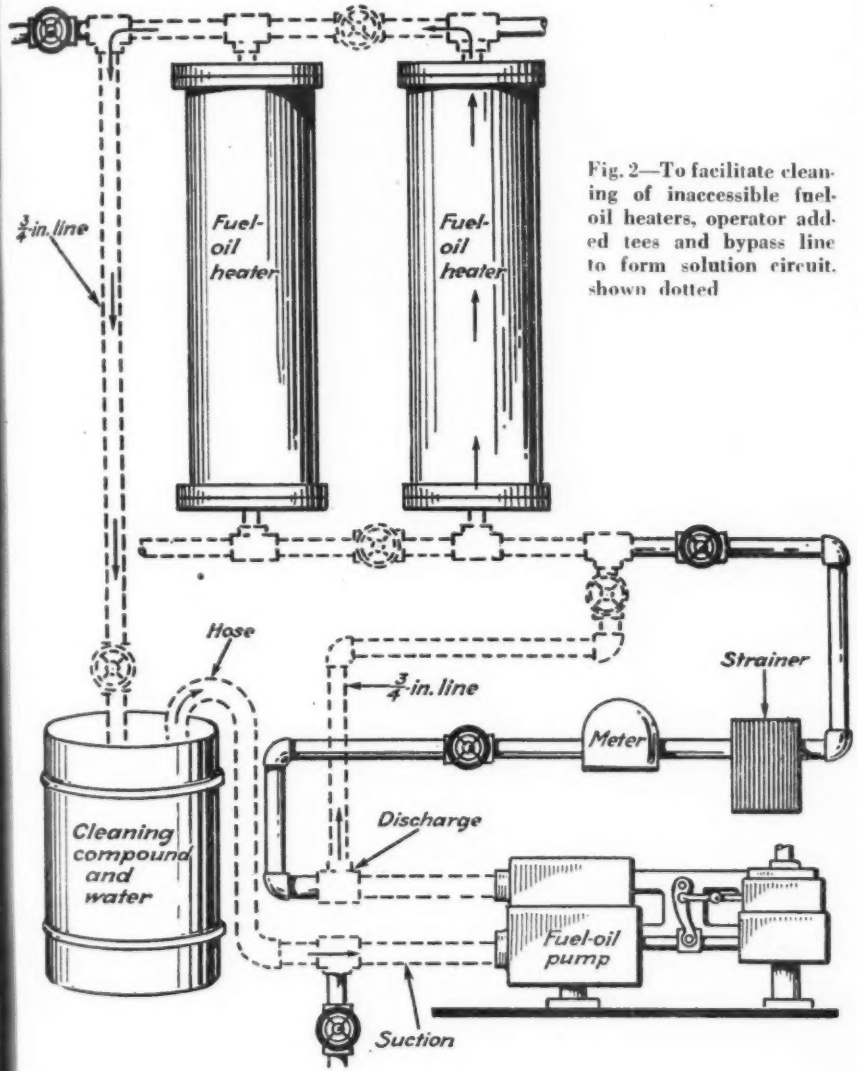


Fig. 2—To facilitate cleaning of inaccessible fuel-oil heaters, operator added tees and bypass line to form solution circuit, shown dotted

Cleaning Methods

So much for the factors involved in finding the right cleaner for the job. Before examining power-plant cleaning problems in detail and recommending materials, it might be well to look at the general methods of applying cleaning solution. They fall into several broad classifications, depending on the nature of the equipment or surface to be cleaned and the equipment available.

Naturally, cleaning large units in place, without dismantling, proves most convenient and desirable from the standpoint of time and cost. If such jobs are tackled regularly on a routine basis so that excessive deposits do not build up, circulation of the cleaning solution through areas to be cleaned forms the best all-round method. This may be done by rigging a special setup for each job as it occurs, but in the average plant where a fairly large number of units require cleaning, a portable outfit pays dividends in convenience and time saving.

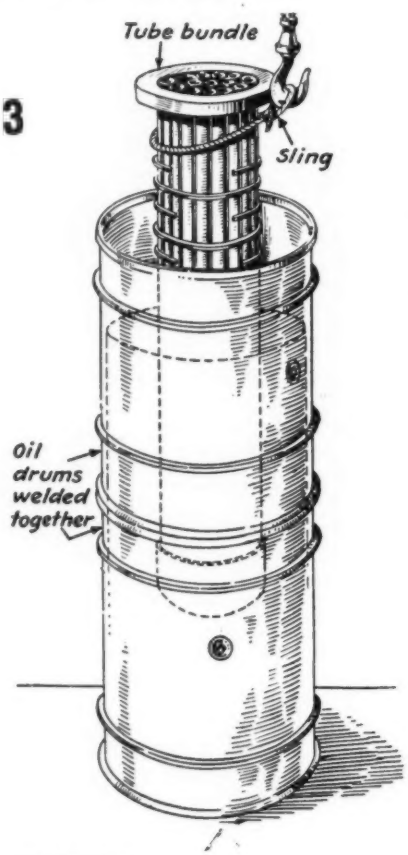
Such an outfit consists in essence of a container for the cleaning solution, with

provision for heating the fluid when required, a small pump for circulating it, and a container to receive the returned solution. Fig. 1 suggests a portable arrangement. Two oil drums, mounted on a skid base, serve as solution containers. Drum for the solution contains a heating coil and connects to the receiving drum by a short length of pipe set at the point of desired solution level. A screen at the top of the receiving drum strains out large particles of scale or dirt from the solution coming out of the equipment being cleaned. Pump draws suction from the solution container and discharges through a hose connection to the equipment to be cleaned. Pump may be motor driven, as shown, with a plug-in connection, or steam driven with a hose connection. If the cleaning unit is to be used with inhibited-acid solutions, it is advisable to line the drums with bitumastic and install an acid-resistant pump.

Using Existing Piping

Sometimes it may prove convenient to make slight alterations in existing equipment piping to permit cleaning. Fig. 2 shows such an arrangement for cleaning fuel-oil heaters where inaccessibility made dismantling difficult. Replacing an elbow in the pump suction provided a connection for a hose leading to a barrel of cleaning solution. Two tees in the pump discharge line bypass meter and strainer, giving a direct connection from pump to heaters. A tee in the discharge from the heaters provides a return connection to the solution barrel. The pump takes care of circulation; dotted lines indicate circuit of the cleaning compound.

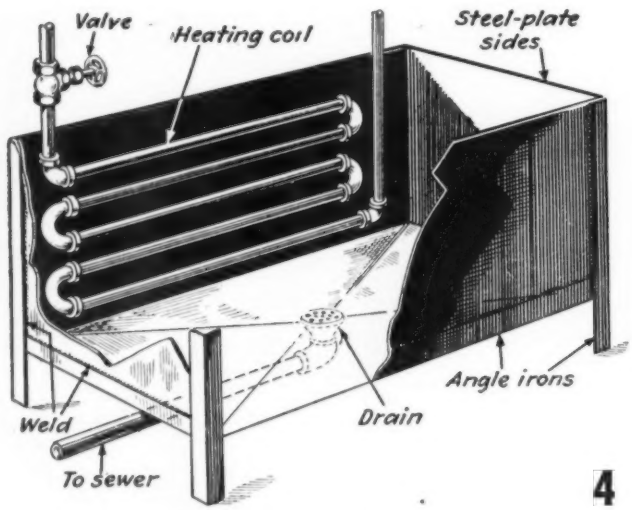
Immersion of parts to be cleaned in a drum or tank of cleaning solution forms a common method of handling, but is restricted in usefulness to parts or items of equipment of reasonable size that may be dismantled without extreme inconvenience. Fig. 3 shows how one utility plant handles immersion cleaning of heat-exchanger tube bundles. Two oil drums welded together form the solution container, into which the bundle is lowered. A steam hose may be used if heat is required, and an air hose furnishes agitation.



For cleaning valves, engine parts and other relatively small items, a home-made tank like that in Fig. 4 often proves worthwhile. Steam coils at the side provide heat when required, and an air hose may be used for agitation. Drain connection should run to the sewer, if possible. Where steam is not conveniently available, immersion heaters (gas, oil or electric) or open flame burners underneath may be installed. Where large-scale salvage operations serve a large plant or a number of plants, increase tank or vat size to handle pipe in normal lengths; lower small parts into the vat in a perforated-metal basket. If tanks or vats handle acid solutions, always protect them with an acid-proof lining of bitumastic or other material. Where volume of work justifies it, best results may be obtained with special parts-cleaning tanks offered by several manufacturers.

In addition to circulation and immersion cleaning, a third general method, exterior washing, involves a wide variety of problems and an equally wide range of methods. One common job is paint stripping, for which Fig. 5 shows a suggested setup. A drum mounted or suspended at least 10 ft above the top of the equipment holds the stripping solution; hoses provide for filling and heating. From the bottom outlet of the drum a ¾-in. hose of convenient length connects to a 4-ft length of ½-in. pipe carrying at the end a flat nozzle which gives a thin sheet of solution rather than a round stream.

The article to follow will include specific instructions on cleaning materials to use, solution strength and application procedures.



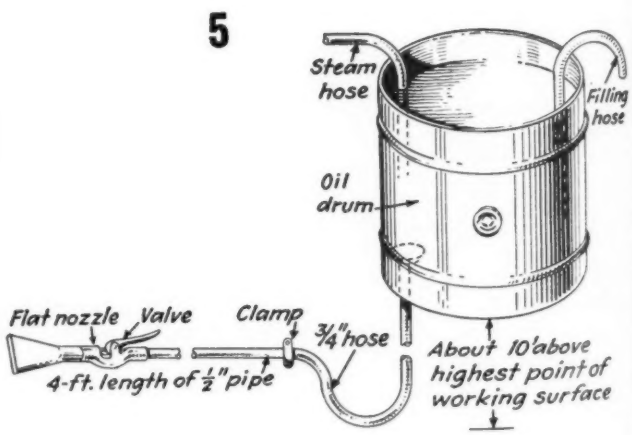


Fig. 3, *top*—Two oil drums welded together form solution tank for cleaning heat-exchanger tube bundles. Fig. 4, *left*—Suggested design for small-parts cleaning tank, with heating coil. This tank, and one in Fig. 3, should be suitably protected if acid cleaners are used. Fig. 5, *right*—Setup for paint-stripping operations on equipment, using flat nozzle for thin stream

Curing Compressor Ills Saves Money

Maintain full capacity and economical operation by keeping your compressor in good mechanical repair. H H Miller, Worthington Pump & Machinery Corp, discusses faults that consume extra horsepower for every cubic foot discharged

DEFECTS THAT UP COMPRESSOR COSTS

1. Valve leakage
2. Valve slip
3. Small valve area
4. Piston leakage
5. Heating intake gas
6. Poor cooling

▶ HORSEPOWER REQUIRED to drive a compressor consists of work done on the air within the cylinder, plus friction loss in the moving parts. In a motor-driven compressor, total horsepower is stated as brake horsepower developed at the compressor shaft. Adding the motor electrical loss gives the electrical horsepower input. With steam-driven compressors, total horsepower (steam-indicated horsepower) is the gas-end horsepower determined by indicator cards from the compressor cylinders, plus friction loss in the machine. It may be checked by taking indicator cards on the steam cylinders simultaneously.

As with volumetric efficiency, which decides actual compressor capacity, several factors that determine the horsepower required to compress gas (June, POWER, page 69) are controlled by natural laws. However, many of its man-made factors are controllable within certain limits. Here we will deal principally with the latter and point out problems the designer must solve to insure maximum compressor economy.

Compressor Efficiency

Compression efficiency of a gas compressor is defined as the ratio of the theoretical horsepower required to the horsepower shown by indicator cards taken from compressor cylinders. Theoretical horsepower is usually based on adiabatic compression. Compression efficiency concerns itself entirely with work done inside the compressor cylinder, bearing no relationship whatever to anything else. High compression efficiency requires less work and therefore less horsepower for compression, which results in a more economical compressor.

Since adiabatic compression is usually used when computing the theoretical horsepower, actual horsepower required is within the designer's control to the extent that he can influence the transfer of part of the compression heat

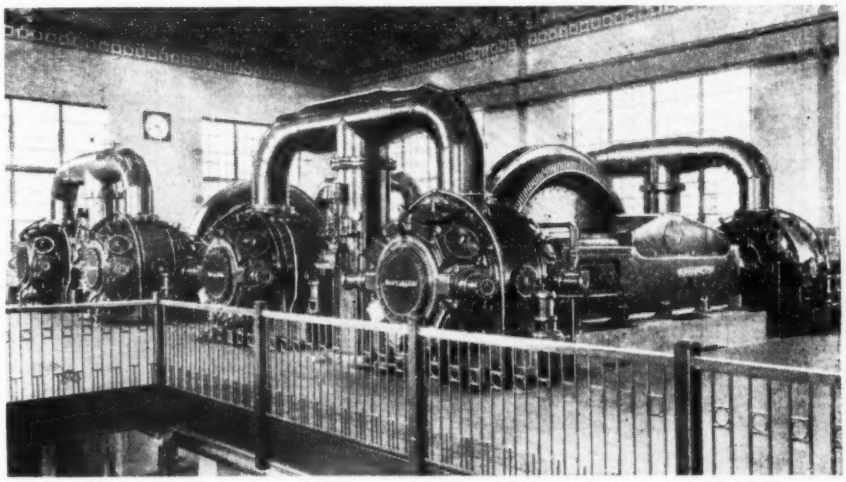


Fig. 1—Cylinder jackets must be kept clean so that cooling water absorbs a maximum amount of heat. When intake gas picks up heat, compressor capacity drops

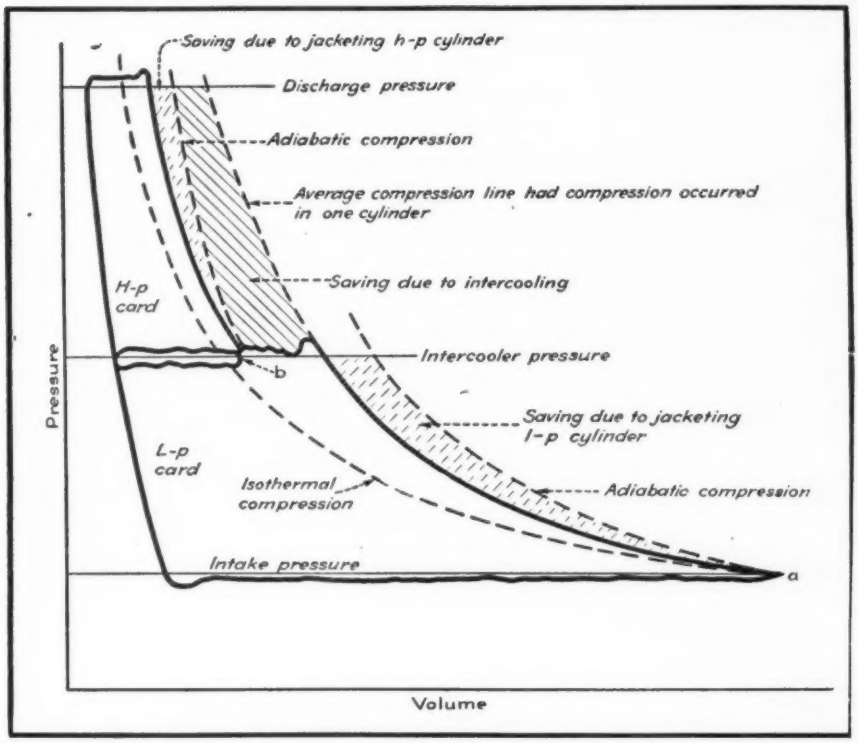


Fig. 2—Cylinder jacketing and intercooling reduce the power required by the compressor because this brings the compression line nearer to isothermal conditions

Approximate Horsepower to Compress Air or Gas

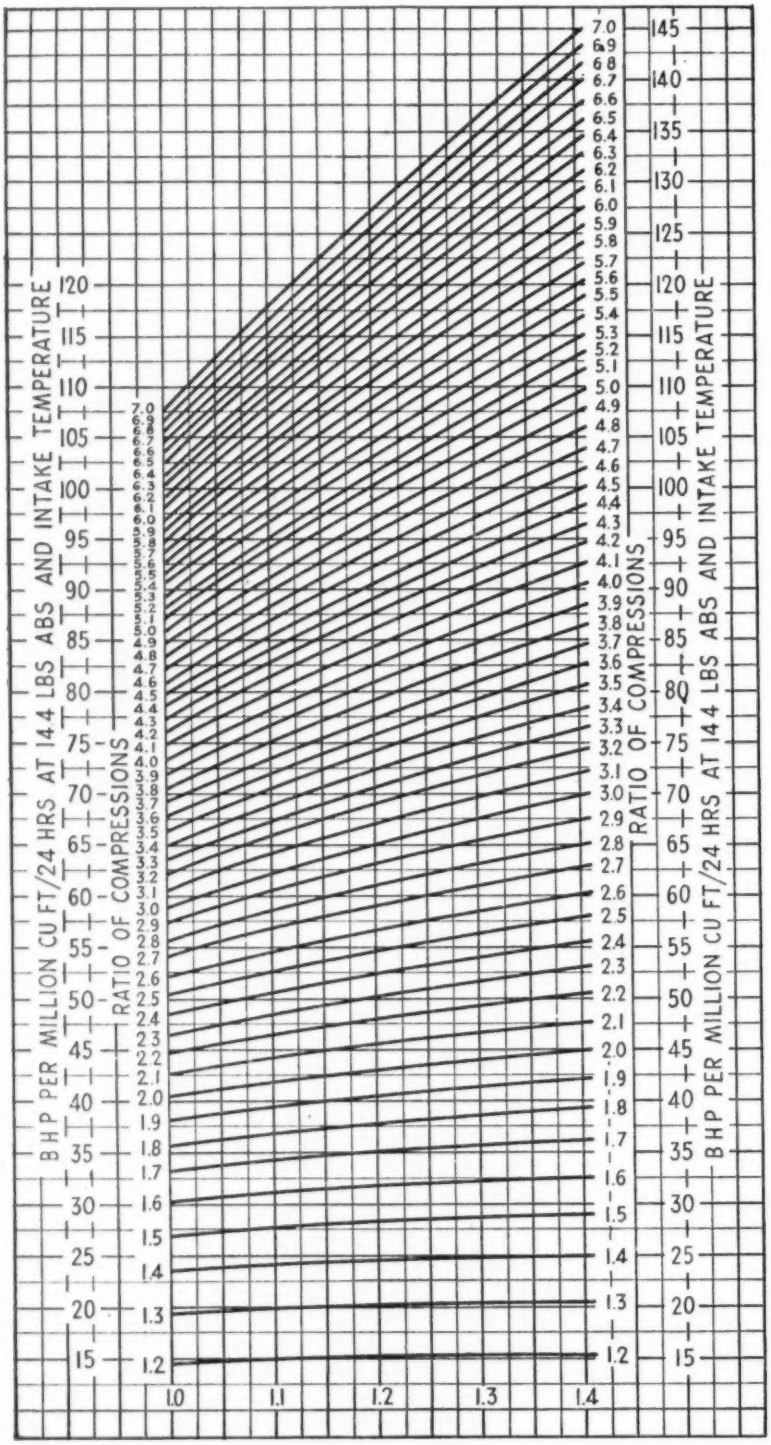

B HP PER MILLION CU FT/24 HRS AT 14.4 LBS ABS AND INTAKE TEMPERATURE
RATIO OF COMPRESSIONS
B HP PER MILLION CU FT/24 HRS AT 14.4 LBS ABS AND INTAKE TEMPERATURE
RATIO OF COMPRESSIONS
1.0
1.1
1.2
1.3
1.4

Fig. 3—The exponent *n*, horizontal scale above, affects horsepower required. If compressor is single stage, multiply cfm actual capacity by 1440 to obtain million cu ft per 24 hr. Then capacity in 24 hr, times hp per million as obtained from the chart, gives the total horsepower. For 2-stage compressor, take square root of total number of compressions. Read the hp from chart for this ratio and multiply it by 2 for the 2 stages, to which add 3% for cooler loss. *Note:* Hp is for 14.4 psi abs intake. If hp is wanted, based on capacity at 14.7 psi abs, add 2%

to surrounding water jackets. The more heat carried away, the more economical the compression.

One problem, therefore, is to design the cylinder jacket so that maximum Btu is transferred from the gas to the cooling water. Jacket efficiency naturally varies not only with cylinder design but also with its size, as well as with piston speed. With a given discharge pressure, results are measured to a considerable extent by the ratio of cooling surface to cylinder capacity per minute. Amount of jacketing area compared to capacity is greater in small than in large cylinders, Fig. 1, piston speed remaining the same. For this reason, single stage for 150 psi is perfectly safe practice with a 6x7-in. compressor, whereas 2-staging is frequently resorted to on large units for pressure as low as 50 psi because excessive discharge temperature results from single-stage compression to high pressures in large cylinders.

Removing Heat

Intercooling with two or more stages is more or less allied to cylinder jacketing, Fig. 2, because it is just another means of removing compression heat. Perfect intercooling is obtained when the high-pressure intake gas temperature is lowered to that of the low-pressure intake—condition possible with properly designed intercoolers using cooling water 20 F colder than the incoming gas. Here are other factors that influence the horsepower developed within a compressor cylinder:

Exponent of compression curve. Exponent of the compression formula PV^n is determined by dividing the gas specific heat at constant pressure by its specific heat at constant volume. For air, the exponent is 1.406. In the table of gas properties, June POWER, page 70, note that the *n* value varies widely with different gases. The lower the *n* value, the lower the theoretical horsepower required.

Nearly all gases require less horsepower for a given free gas capacity than does air, and the exponent's effect on horsepower is evaluated on the chart, Fig. 3. Horsepower to compress a gas with any exponent is readily ascertained from these curves. They are approximate actual values, not theoretical, and vary slightly with compressor efficiency. Capacity is in terms of free gas at 14.4 psi abs and intake temperature. If intake is at 14.7 psi abs, horsepower increases in the ratio of absolute pressures. If the gas capacity is measured at other than intake temperature, the horsepower changes in the ratio of absolute temperatures. These corrections are readily

made when results are desired on the basis of standard gas—14.7 psi abs and 60 F.

Valve leakage. Valve leakage during compression impairs compression efficiency. Discharge-valve leakage may occur on both suction and compression strokes. On the suction stroke, it occurs while inlet valves are open, and hence causes both capacity and horsepower loss. Since intake valves are open, this leakage does not show up on the indicator card. The discharge-valve leakage during the compression stroke raises the compression line on indicator card.

Intake-valve leakage during compression permits partially compressed gas to leak back into the intake pipe. While suction-valve leakage lowers the compression curve and reduces the indicator card's area it, nevertheless, is a power loss because the loss of partially compressed gas results in decreased capacity. Leakage from the high-pressure cylinder passes back to the intercooler, raising its pressure, and, of course, must be recompressed. Such leakage may raise the intercooler pressure sufficiently to open the relief valve.

Valve slip. Efficient compressor valves must respond to flow through them, so that they close instantaneously when the piston reaches the end of its stroke. If the valve is a trifle sluggish, a certain amount of compressed gas slips back through it at the end of the stroke before it seats. This, naturally, is a loss of volume affecting the machine's capacity and, at the same time, a loss of power because work has been expended in compressing the lost gas. Therefore, compressor valves must act instantaneously to eliminate slip.

For example: An 18x11x12-in. direct-connected motor-driven compressor with 1055 cfm piston displacement operates at 300 rpm. Running at this speed it makes 10 strokes per second, and the valves must function within a small fraction of a stroke. Inlet valves function at the beginning and end of the stroke when piston speed is at a minimum, but discharge valves must open in mid-stroke when piston speed is at maximum. To be efficient, the discharge valves must function within about 1/100 of the stroke travel, or within 1/1000 of a second, which is exceedingly fast operation for mechanical parts. This shows why compressor valves cannot have weight, inertia or cushioning devices that slow their speed.

Valve area. Difference of pressure is required to cause gas to flow through valves. A certain amount of frictional resistance results, and valve and port areas must be liberal to minimize this loss, Fig. 4. Likewise, all cylinder intake and discharge passages must be large enough to hold down frictional loss. Obviously, reducing these losses to a minimum is within a skillful designer's control, but it means larger and slightly more costly cylinders.

Piston leakage. When piston rings or cylinder bore are in bad shape, leakage from the compression end of the cylinder to the end taking suction is definitely a capacity loss because the leakage partially fills the cylinder and excludes that much new gas. It is also a power loss because gas partially compressed, on which work has been expended, releases to atmospheric pressure.

Heating at the intake. Gas from the intake line picks up heat as it contacts hot metal surfaces of the cylinder before the intake valves close. It then expands and less weight goes into the cylinder, which results in a capacity loss in the ratio of absolute temperatures. An increase in horsepower also results because capacity is measured at the intake, and any heating that occurs within the cylinder is chargeable against the machine. Heating the intake gas, valve leakage, valve slip and piston leakage—all increase the discharge temperature.

These losses are never recovered but are, at least in part, controllable by careful compressor design and diligent maintenance. Any determination of the horsepower required by the compressor does not furnish data on compressor economy because it is necessary to know how much gas the compressor is actually delivering. The complete story of compressor efficiency is told when the brake horsepower and the actual capacity delivered by the compressor are determined.

True Performance

It follows, then, that the brake horsepower per 100 cfm of actual capacity is the only accurate measure of true compressor performance. Obtain it by dividing total brake horsepower by actual, delivered capacity. With steam-driven compressors, total horsepower must be ascertained by indicator cards from steam cylinders; with motor-driven compressors, it is difficult to separate compressor efficiency from motor efficiency in any combined direct-connected unit. Therefore the compressor brake horsepower must be secured from the electrical horsepower and motor efficiency.

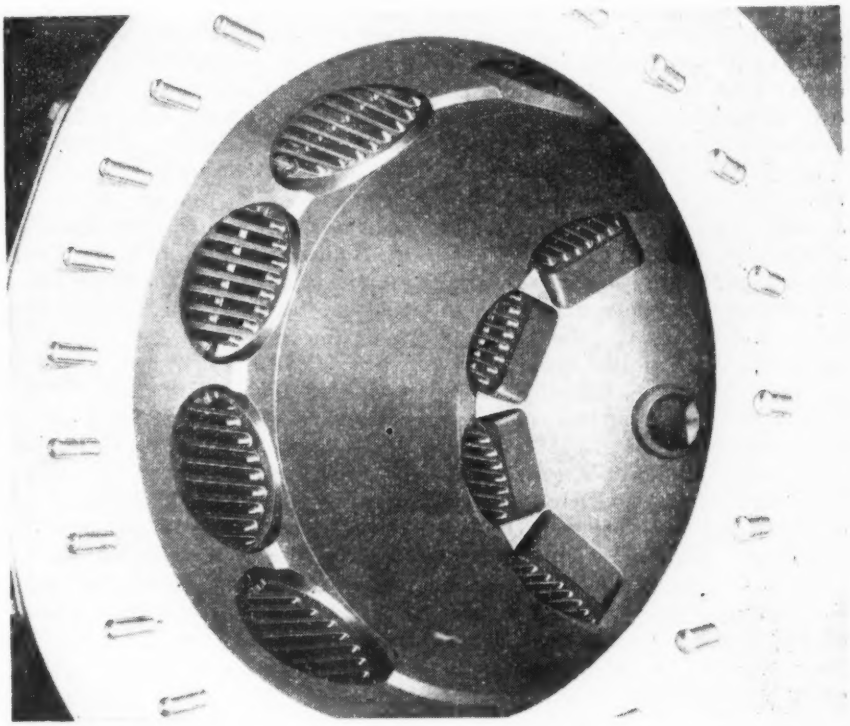


Fig. 4—Entire cylinder circumference may be utillized to provide maximum valve area. This reduces friction loss and pressure drop through the valves and passages

Correction

Diagrams of single-shaft and two-shaft gas turbines were unfortunately interchanged on pages 92 and 93 of Mr. Sidler's timely article in the September number of POWER, "Typical Specifications for Gas-Turbine Power Units"

Power and Industrial Projects Widen Opportunities in Pacific Northwest

Bonneville Power Administration details a postwar program to use 1,300,000-kw hydroelectric capacity installed at the Bonneville and Grand Coulee plants, plus about 3,000,000 kw to be added as soon as the funds are available

▶ THE COLUMBIA RIVER, with tributaries in Oregon, Washington, Idaho, Montana, Wyoming, and in Canada, is one of the greatest waterpower sources in the world. Grand Coulee and Bonneville, now developed for a capacity of over 1,300,000 kw, supply power to Government and privately owned metal-refining and other war-industry plants. Keeping in mind that much of this capacity will be available for other purposes at war's end, Bonneville Power Administration, in cooperation with other interested agencies, has completed a comprehensive study of Pacific Northwest opportunities.

The program is based on the Columbia River's power, navigation and irrigation possibilities. As the map shows, the river rises in Columbia Lake, Canada, and flows north about 200 miles through a series of lakes. Then flowing south through another series of lakes for about 250 miles, it enters the United States in the northwest corner of Washington. From the Canadian border the river falls about 1300 ft in its 600-mile flow to the Pacific.

Its principal tributary, the Snake River, rises at an elevation of 7500 ft in Yellowstone Park, Wyoming, drains a large part of Idaho, northern Nevada and eastern Oregon. Clark Fork, draining northwestern Montana and northern Idaho, and flowing into the Columbia just inside the Canadian border, is an important factor in the Columbia system because of its water storage, irrigation and power possibilities.

Of the projects on tributaries of the Willamette River, the Detroit is the most important, planned for 90,000-kw power and 320,000 acre-ft storage. Other projects are comparatively small water-storage developments. The Columbia and its tributaries within the United States are estimated to have potential power possibilities of about 13,000,000 kw.

Shown on the map opposite are 29 projects on the Columbia and its tributaries, of which only five have been built. They are: *Grand Coulee*, designed for 1,944,000 kw, with 800,000 kw installed; *Bonneville*, completed, with 518,000 kw installed; the privately owned *Rock Island plant*, designed for 240,000 kw, with 60,000 kw installed; *Fern Ridge and Cottage Grove storage dams*, with combined storage of 135,000 acre-ft on the Willamette River. *Anderson Ranch project*, designed for 20,000 kw, on a tributary of the Snake River, is now under construction.

Scheduled for development as soon as funds are available are *Umatilla*, 630,000 kw, and *Foster Creek*, 675,000 kw, on the Columbia River. On the Clark Fork are *Hungry Horse*, 142,000 kw, *Cabinet Gorge*, 99,000; on the Snake River, the 30,000-kw *Palisades* and 120,000-kw *Cascade developments* and on a tributary of the Willamette, the 90,000-kw *Detroit plant*. The table gives a brief summary of these projects.

Power from plants now in operation and those proposed for early development by the federal government represents a total installed capacity of nearly 4,500,000 kw. This power is over and above that produced by private companies and municipalities, which supplied Washington, Oregon and Idaho before the present war program developed.

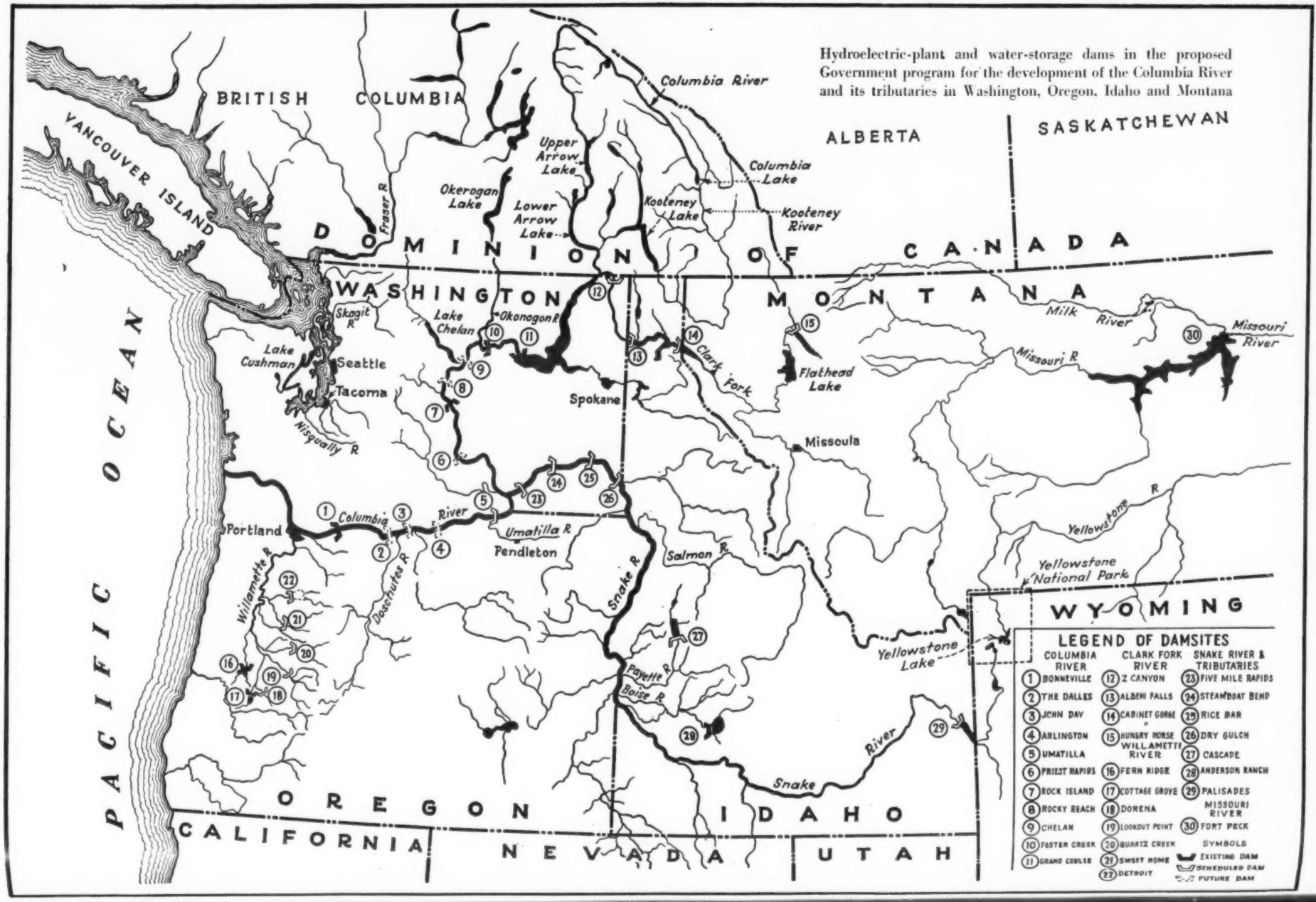
According to the proposed plan, a market is to be found in new industries, particularly metallurgical, which low-cost power will attract to this area; also for pumping irrigation water, heating and increased power consumption in homes, electrification of farms and railroads, and electric boilers to supply industrial steam.

In addition, there are possibilities of building large metal-refining and industrial loads because this section of the country is rich in natural resources that can be converted into manufactured products. Many of these proposals may not materialize, but some are not so vague as they may sound. For example, the irrigation-water pumping plant at Grand Coulee will have twelve 65,000-hp pumps, a total of 800,000 hp. At present, 125,000 kw are required to pump irrigation water. It is estimated that this load can be increased to 1,170,000 kw, requiring over 4,000,000,000 kwhr annually.

Power Projects on Columbia River and Its Tributaries
Completed or on Government Program for Postwar Completion

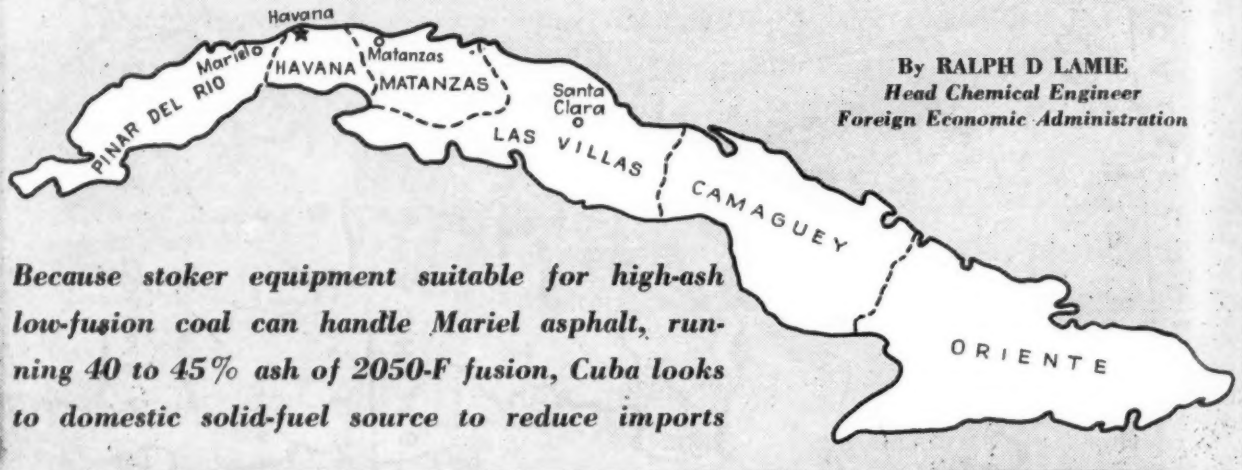
Project	State	River	Ultimate capacity, kw	Installed capacity, kw	Head, ft.
Hungry Horse	Mont.	Flathead	142,000	None	432
Cabinet Gorge	Idaho	Clark Fork	99,000	None	112
Grand Coulee	Wash.	Columbia	1,944,000	800,000	350
Foster Creek	Wash.	Columbia	675,000	None	150
Rock Island*	Wash.	Columbia	240,000	60,000	27
Umatilla	Wash. & Ore.	Columbia	630,000	None	85
Bonneville	Wash. & Ore.	Columbia	518,000	518,000	60
Detroit	Ore.	Willamette	90,000	None	275
Anderson Ranch	Idaho	Snake	20,000	None	...
Cascade	Idaho	Snake	120,000	None	...
Palisades	Idaho	Snake	30,000	None	...

*Owned and operated by the Puget Sound Power and Light Co



Hydroelectric-plant and water-storage dams in the proposed Government program for the development of the Columbia River and its tributaries in Washington, Oregon, Idaho and Montana

Test Shows High-Ash Cuban Asphalt May Make Satisfactory Boiler Fuel



By RALPH D LAMIE
Head Chemical Engineer
Foreign Economic Administration

Because stoker equipment suitable for high-ash low-fusion coal can handle Mariel asphalt, running 40 to 45% ash of 2050-F fusion, Cuba looks to domestic solid-fuel source to reduce imports

► WITHOUT SUBSTANTIAL SOURCES of solid or liquid fuels, Cuba depends to a large extent on imports and use of waste fuels such as bagasse. If asphalt deposits, which occur in all six provinces, could be burned with reasonable efficiency under existing boilers without resetting, Cuba would have a domestic source of solid fuel. To investigate the problem at the request of the Cuban government, the Board of Economic Warfare, now the Foreign Economic Administration, sent a technical mission to Cuba. On its return to the United States the mission initiated certain experimental work.

First promising results came, not from removing part of the high ash content as had been expected, but from burning natural asphalt on grates developed for burning high-ash low-fusion coal. Necessarily limited tests indicated that Mariel asphalt, most plentiful, can be handled successfully in such stoker equipment. Outlined here are the characteristics of asphalt as a fuel, the difficulties attendant on burning it, and tests on pneumatic spreader-stoker equipment.

Cuban deposits vary in purity from an almost pure asphalt having only a fraction of one percent ash to asphaltites having as high as 50%. Quantities available and production cost limit consideration to two types, designated as Santa Clara and Mariel because most of the prospective tonnage comes from these localities. (See map above.)

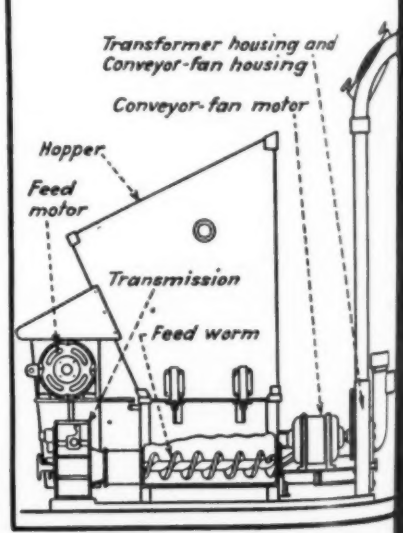
Santa Clara asphalt shows a medium ash content, about 22%, and Mariel runs about 42%. Both have high sulphur content—5 to 6%—and in both the ash is finely divided and quite uniformly distributed throughout the mass. Moreover, the ash contains a high percentage of volatile matter in an absorbed condition. For these reasons, no practical method has yet been devised for substantially reducing ash content by washing or other mechanical means. Effective and economical utilization of these asphalts as fuel depends, therefore, on finding satisfactory methods of burning them as mined.

Mariel Asphalt Plentiful

Santa Clara asphalt, of lower ash content, is burned in pulverized form, but for best results boilers must be set high enough to construct under them a slagging ash floor. Supply of Santa Clara asphalt is limited, however, whereas potential production of Mariel is large and location of the deposits makes the high-ash asphalt more readily available to large industrial consumers in and around Havana.

Experience in burning high-ash asphalt on ordinary grates or stokers has been discouraging. Difficulties seem to arise from low melting point of the fuel (350-450 F), high ash content (40-45%) and low fusion point of the ash (2050 F). In the ordinary natural-draft firebox fitted with open grates, poor combustion rates and low efficiencies result. If hand fired, the fuel must be fed a small amount at a time while the fireman works it frequently to keep it burning at an even rate, removing ash almost constantly. Combustion can be controlled only approximately and heat losses from excess air are large.

On multiple-retort stokers, low melting point of fuel and low-fusion point of ash caused clogging of air ports. Op-



General design and schematic arrangement of stoker hopper, feed screw, transfer fan, conveying pipe (facing page) and nozzle in 3-drum low-head boiler fitted with stationary grate

eration with both 22% and 45% ash asphalts, and with both, asphalts mixed with coal up to four times their weight, led to the conclusion that the fluid slag made these fuels unsuitable for underfeed equipment.

Hershey Corp tried burning pulverized high-ash asphalt at their plant in Matanzas Province, using for the tests a boiler installation designed for pulverized coal. Fuel burned analyzed as follows:

Moisture	5.97%
Volatile matter	39.50%
Fixed carbon	12.73%
Ash	42.00%
Sulphur	5.85%
Heating value, Btu/lb.	7638

At an average combustion rate of 4000 lb per hr, evaporation rate was 18,000 lb per hr. Indicated boiler efficiency of 70.7% led to the conclusion that Mariel asphalt proves a reasonably good fuel if properly handled.

However, operating difficulties which could not be overcome forced abandonment of this fuel. The company's report listed some of the difficulties as follows:

"The clinker formation on the furnace side walls in higher temperature regions is very rapid and serious. With continuous lancing and cleaning, we were able to keep a boiler on the line for 55 hours, after which it had to be taken off. The clinker builds up to such an enormous size that there is danger of serious damage to the refractory walls.

"We anticipate a substantial increase in the cost of furnace repairs if this fuel has to be fired at higher ratings."

After making the above tests, operators tried, with more satisfactory results, the same type of fuel with a lower ash content, averaging 20%. Fortunately, the boilers were set high enough so that the ash floor could be sloped to a side outlet for removal of ash as semi-molten slag. With this arrangement, reasonably satisfactory operation can be maintained continuously, but erosion of combustion-chamber brickwork continues to give some trouble.

Spreader-Stoker Test

These experiences led to the deduction that a spreader stoker might solve the problem because such equipment had demonstrated ability to handle a wide range of high-ash low-fusion coals. Accordingly, the engineering staff of the Foreign Economic Administration made arrangements to test Mariel asphalt at the Cleveland plant of Iron Fireman Mfg Co. The stoker used was a pneumatic spreader of 1600-lb-per-hr coal-feeding capacity.

Diagram below shows general design and schematic arrangement of the equipment. A feed worm picks up the fuel in the hopper and meters it to a transfer housing, from which it is conveyed by air through pipe to an adjustable nozzle which distributes the fuel over the grate area. Test boiler was a 3-drum low-head Erie City unit, of 2500-sq-ft heating surface. The special grate measured 72 in. long by 56 in. wide, giving a total grate area of 28 sq ft. There was 9 ft of headroom.

Fuel received no special preparation except crushing large lumps down to a maximum of about 1½ in. Proximate and ultimate analyses were as follows:

Proximate Analysis
(as received)

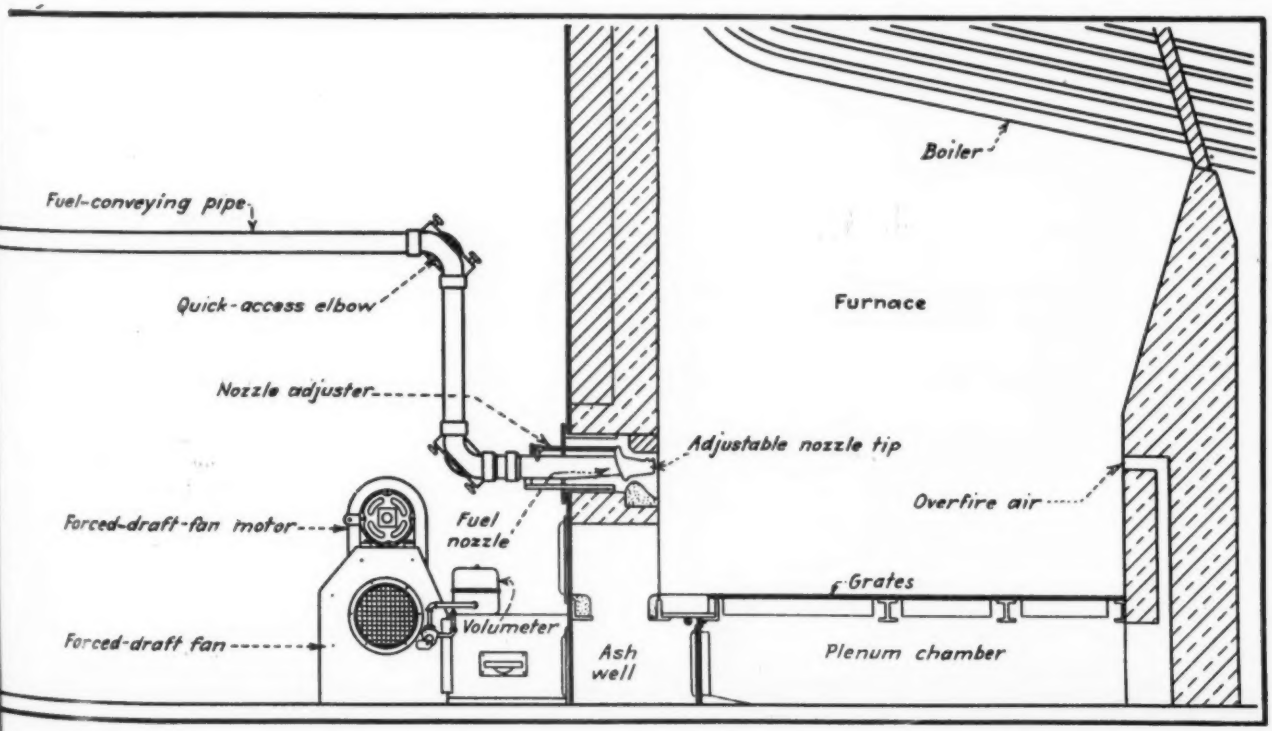
Moisture	3.05%
Volatile matter	39.80%
Fixed carbon	18.33%
Ash	38.82%
Ash fusion temperature, F.	2074
Heating value, as fired, Btu/lb.	9993

Ultimate Analysis
(dry basis)

Carbon	46.66%
Hydrogen	4.81%
Oxygen	1.34%
Nitrogen	0.64%
Sulphur	6.13%
Ash	40.42%

Operating conditions were checked as follows: (1) *Fuel consumption* — by Howe platform scale (2) *Exit-gas CO_2* —by Ranarex recorder; checked periodically by Hays orsat (3) *Exit-gas temperature* — by thermocouples in breeching, indicated on Leeds & Northrup potentiometer (4) *Plenum pressure*—by Meriam manometer (5) *Furnace draft*—by Hays draft gage.

Operators cleaned the fire manually at about 90-min. intervals. Allowing a deeper ash bed to accumulate would have permitted an increase in the inter-



val, but operators believed that ash accumulation during this period was about normal for average fire-cleaning conditions.

Draft Compensation

Device in diagram below, an integral part of the stoker equipment, compensates for varying fuel-bed resistance and delivers correct amount of combustion air. Velocity vanes actuate a valve regulating air pressure on a diaphragm which, in turn, makes a compensating adjustment of the forced-draft damper position. With the high-ash Cuban asphalt ash on the grates varied from 0 to 10 in. in depth over an interval of 2 hr at the test burning rates. Without air-volume control this variation in fuel-bed resistance would have caused changes in air supply and loss of combustion efficiency.

Actual testing time was six hours; lack of asphalt fuel precluded a longer run. Observers agreed that operating conditions were not changing and there appeared to be no reason why operation could not continue indefinitely. Test results appear in Table I.

The asphalt burned with only 15.5% excess air. As a result, high efficiency was obtained although ashpit loss was higher than necessary. Combustible matter remaining in the ash from individual cleanings was: (1) 15.50%, (2) 12.33%, (3) 10.94%, and (4) not sampled, but it appeared to be lower than in any previous test. Each ash sample was reduced by quartering and preserved for analysis. Samples of fuel and flyash from cinder hoppers were also taken and preserved for analysis.

In calculating the heat balance, average of first three cleanings (12.42% combustible) determined ashpit loss. This totaled 7.60%, including estimated flyash emission. With more careful operation, carbon content of ash should not exceed 10%. Reduction from 12.42% to 10% increases efficiency about 1.75% by lowering carbon loss from 7.60 to 5.85%.

It seems likely that further experience with the fuel will prove that slightly higher primary air will increase efficiency. Increase in dry gas loss resulting from boosting excess air to 25% might be more than offset by a further reduction in ashpit loss. The relatively low ash-fusion temperature might cause slagging difficulties when operating at high ratings with low excess air. This, of course, depends on rating, amount of boiler surface exposed to the fire, firing rate and length of flame travel.

No Trouble at High Rate

Test firing rate averaged 40.7 lb per sq ft of grate per hr and rose to about 60 lb during the last 15 min. Although these rates are relatively high, no difficulty was encountered. Heat release averaged 22,800 Btu per cu ft hr; complete absence of smoke or slag indicates that this can be exceeded even in boilers without waterwalls.

Asphalt burned during this test proved a satisfactory fuel for the spreader stoker. As in spreader firing of coal, fine particles ignited and burned in suspension. However, a fairly large proportion of the asphalt burned on the grate. Tendency of the asphalt to swell rapidly and form a light fluffy coke seemed the primary reason for the good burning characteristics. Such coke, having a notably low density, exposes a large area to contact with oxygen in the furnace. This forms a possible explanation for the short flame observed and almost complete absence of smoke formation.

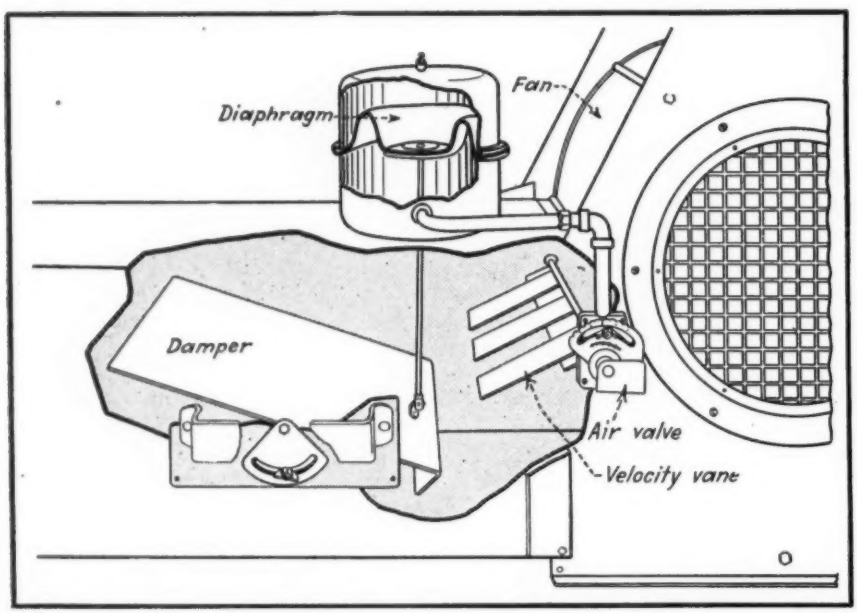
Ability of the spreader stoker to burn successfully material of extremely low melting temperature lies in the fact that the equipment feeds and distributes fuel uniformly on the grate before temperature rises to the softening point. With the exception of the nozzle tip, asphalt does not come in contact with any stoker part having a temperature higher than the surrounding air, and in the nozzle the asphalt is maintained below its melting point by the stream of conveying air. Any single particle passes through the nozzle tip in about 1/100th second—far too short a time to cause softening.

Thus the technique of firing Mariel asphalt in a pneumatic spreader stoker resembles standard practice with bituminous coal, using room temperature conveying air instead of the mixture of combustion gas and air often used with coal. Because the ash content of asphalt is high, suitable means for handling refuse from the grates should be provided. The test showed that when asphalt is fired at the rate of 40 lb per sq ft per hr, continuously, it is advisable to remove ash from grates at intervals of 1½ to 2 hours. Probable interval between fire cleanings for any ash content and any firing rate can be determined empirically by dividing 144,000 by the percent ash, multiplied by the burning rate in lb per sq ft per hr. On installations designed to operate at high firing rates, dumping grates appear to be preferable, provided there is under the grates a sufficiently large ash-storage space, from which to remove ash conveniently.

TABLE I
TEST RESULTS

Duration of test, hr.	6
Number of times fire was cleaned	4
Average burning rate, lb/hr/sq ft.	40.7
Maximum burning rate, lb/hr/sq ft.	60.0
Average CO_2 in exit gas, %	13.5
Average excess air, %	15.5
Average over-all efficiency*, %	77.4
Average boiler rating, %	105.0
Maximum boiler rating, %	158.0

** Calculated from heat balance*



Device adjusts forced-draft to compensate for changes in fuel-bed resistance; velocity vanes actuate valve controlling air pressure to diaphragm linked to damper

Diesel Performance Here and Abroad

American and British reports on diesel-engine power costs present invaluable data on operation and maintenance

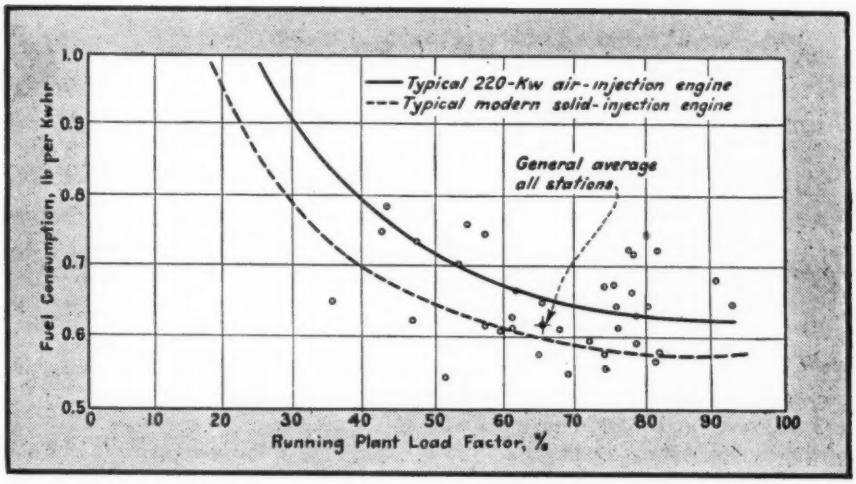
▶ IN THIS the fifth year of world war, the Oil and Gas Power Division, ASME, and the Diesel Engine Users Association of Great Britain have managed to continue their valuable work in the publication of diesel-engine operating and cost records. Both follow the general lines of last year's reports, as extensively reviewed in POWER, April, 1943, p 104-107, and both show an increase in the number of plants and engines covered. The section on automotive diesel engines, a part of the ASME report for the past four years, has grown to such an extent as to warrant publication this year as a separate report.

As in past years, the American report includes charts plotting lubricating-oil consumption, plant fuel economy and engine fuel economy against running capacity factor. Table I gives plant characteristics, operating statistics and a breakdown of operating costs, for each reporting plant. Table II shows comparative figures for the years covered by the reports (1929-1942); figures for two or more years are given on 133 plants, for five or more on 105 plants, for ten or more on 61 plants and for the full period of 14 years on 8 plants. Table III lists 1942 engine details and general operating information.

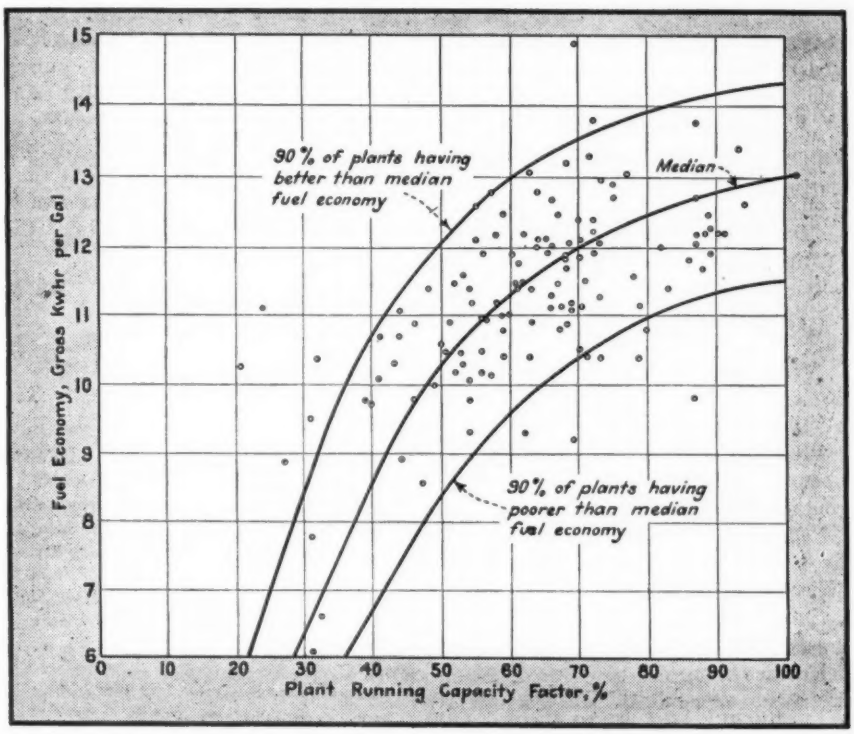
In the British report, fuel consumption in lb per kwhr is plotted against running plant load factor; Table A gives average fuel consumption of reporting plants by years since the first survey (1922-1923). Table B sets forth, in order of merit, plants showing better lubricating-oil consumption than the arbitrary standard of 2380 rated hphr per gal, and Table C shows how the average lubricating-oil consumption has changed since 1922-23.

Wartime difficulties and abnormal conditions that might have distorted the indicated trends led the committee to reproduce without change Fig. 2, giving maintenance costs averaged for 10 to 16 years for a number of plants, and Table D, giving data on liner wear. As usual, the printed discussions of the report include many interesting comments. The following detailed tables complete the British report: Table IIA, costs per unit generated for 31 home stations; Table IIB, costs per unit generated for 11 overseas stations; Table III, average long-period costs of 36 stations; Table IV, waterworks engine costs per water hphr; and Table V, technical details of engine performance.

Copies of the ASME "Oil-Engine Power Cost Report, 1942" may be obtained from Publication Sales Dept, American Society of Mechanical Engineers, 29 West 39th St, New York, N. Y. Single copies are $1.00 to members and $1.25 to non-members. Copies of the DEUA "Report on Heavy-Oil-Engine Working Costs, 1941-1942" may be obtained from the Diesel Engine Users Association, 56 Victoria St, London SW1. Single copies cost 10 shillings and sixpence (about $2.75). Only a limited number of copies is available.



Data from British report shows fuel consumption for reporting plants plotted against "standard" curves for typical air-injection and solid-injection engines



American report shows fuel consumption for reporting plants, in kwhr per gal, plotted against running plant capacity factor. Median lines added to show trend

THE OLD CHIEF

BONERS

Funny remarks on Diagram Cards, leaky faucets and lost vacation days may be minor tragedies to some but to brother engineers they are a man's monuments. A story by William Doran, chief engineer, Essex Co Sanatorium, Ontario, Canada

The girl friend's mother made good use of the wet whisk broom in chasing the luckless Barney out of the house

IT HAPPENS that I am by nature an engineer who likes to fraternize with fellow engineers and those closely associated with my calling. I like to break crusts with them and of an evening talk over a pipe of tobacco. They are my people, they speak my language, and they are the salt of the earth. If they have a common failing, it is their uncharitable ability to remember all the ghastly details of all the *boners* that their brother engineers were ever guilty of. When two engineers recall a former associate, the conversation runs something like this:

"I ran into Brown the other day."

"Don't recall him."

"Sure you do, he was in No. 1 plant with you for years."

"You mean that big, tall fellow that—"

"No, short, thickset fellow. Art Brown."

"Don't recall him."

"Remember the fellow that forgot to open the switch before he changed the contact points?"

"Oh, SURE, you mean Art Brown, lived on Main St, raised fox terriers. Where is he working?"

Such is human nature. A man's boners become a monument by which we remember him.

Barney and Aqua Pura

I know a man well past fifty, who, when he was a youth of seventeen, obtained the foreman's permission to take home the small valve-refacing tools and some bibb washers to fix a leaky faucet. His name was Barney and the job he had set himself was in the home of his newest girl friend.

"Won't take a minute," he told the fair one's mother as he popped down to the basement to shut off the water. Up he came smart as a cricket and unscrewed the bonnet of the faucet. Whatever he had shut off in the basement was evidently not the water because as he unscrewed the bonnet it shot straight up to the ceiling.

The lady of the house tried to stop the deluge by holding a whisk broom over it, while Barney hunted around the basement for the right shutoff. When he finally succeeded, the girl friend's mother made good use of the wet broom in chasing Barney out of the house. Later that night Barney was touring the neighborhood, trying to enlist some one to go back to recover his tools.

Some twenty years later Barney pulled another boner. He was working in a big pulp mill where the men were renewing nozzles on the cooling lines at the grinders. They used water at 80 psi and boosted this with air at 175 psi. One of the pipelines had been pulled about six inches out of plumb while the pressure was off. Barney, who gloried in his strength, attempted with his hands to straighten it while under pressure. It broke at the valve and before he could extricate his arm, the skin and most of the flesh, was blown off the back of his hand.

DIAGRAMS TAKEN OFF ENGINES OF

S.S. LOITEREK

Voyage from HERE to THERE

Hour, ANY HOUR to SO

Draught, Forward, 50' Aft, 2' Mean, VERY

Scale of Diagram, 12" in. = 1 lb.

Diam. of Cylinders, H.P. SMALL Int. BIG L.P. BIGGER in.

Length of Stroke, TOP to BOTTOM in.

Press. of Steam, H.P. SOME Int. ? L.P. NONE lbs.

Mean Pressure, Top YES Bott. NO Mean YEP

Vacuum, 29 inches.

H.P. Expansion, YES SIR

Indicated Horse Power, H.P. Cylinder, COUPLE

" " " Intermediate " ONE

" " " L.P. " NONE

Collective Indicated Horse Power, TOO SCATTERED

Revolutions per Minute, A FEW

Coals per hour, PLENTY cwts., qrs.

day, ENORMOUS

Quality of Fuel, ROTTEN

Tons Cwts. of Coal per I.H.P. per hour, LOTS

Pitch of Propeller, ENOUGH

Speed per Screw, SLOW Knots per hour.

Speed of Ship, DAMN SLOW " "

Percentage of Slip, 132%

Sea, FOR MILES

Mark which Diagram is from top of Cylinder.

REMARKS.

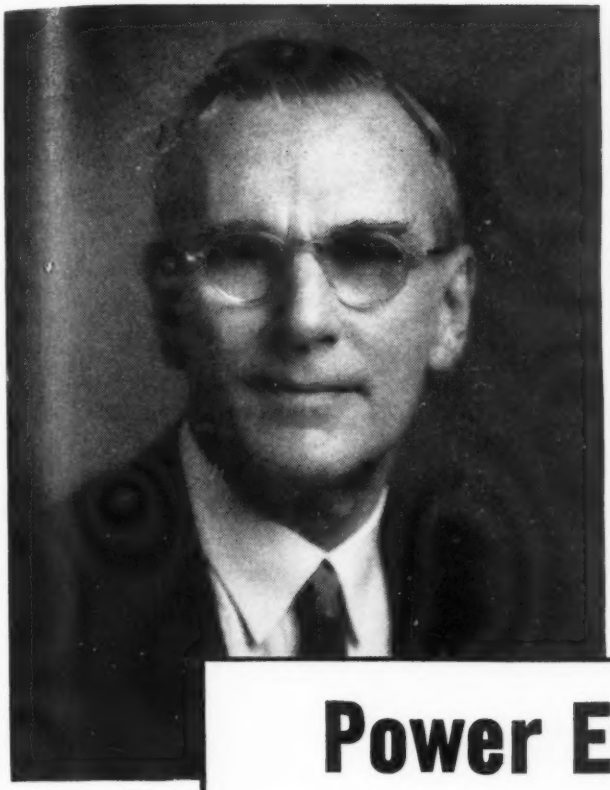
WE ARE GOING TO GET A TURBINE.

DOODLEMACLINK Chief Engineer.

Boners are no respecter of persons. I recall an engineer at sea who was staid, quiet and not given to levity or joking, but one day he slipped. For his own amusement he jotted down a lot of funny remarks on a spare Diagram Card after he had duly filled out the regular one. By some quirk of fate, he stuffed the regular card in his pocket and tabled the funny one on the Chief's desk. The card to the left shows how he filled in the various blanks.

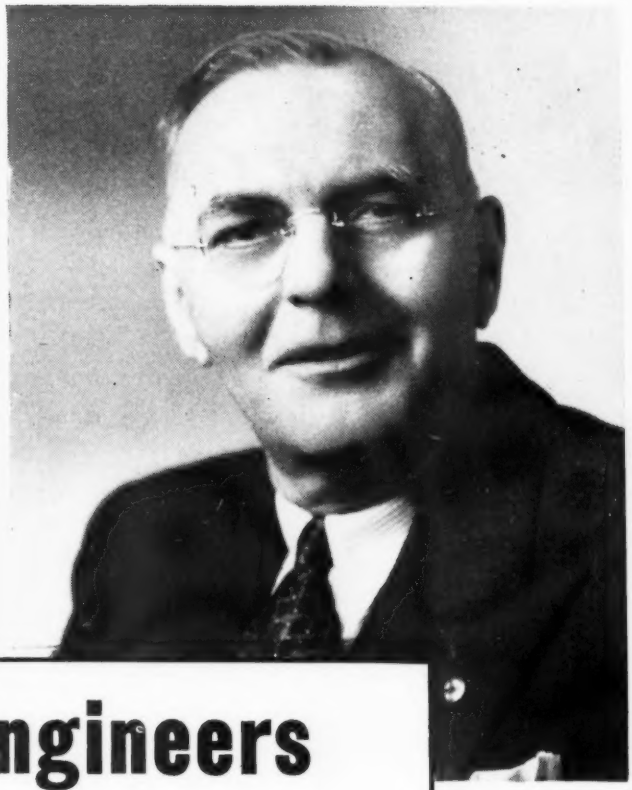
Now chief engineers have been described as a body of men, without heart, conscience or a sense of humor, and this chief was up to standard. He took the matter as a personal insult—an impertinence—and logged him for disrespect. Thus a simple boner became a black mark on the poor fellow's record.

I confess to having made a serious boner myself. One that has haunted me for years. It happened while I was with the Old Chief. It was quite tragic, unprecedented and most certainly uncalled for. My humiliation occurred on the bright day in July when I returned to work from my vacation—*ONE WHOLE DAY BEFORE I WAS DUE TO COME BACK TO THE PLANT!*



Warren D Lewis, national president, widely known as engineer and operating executi.e

Power Engineers Convene in St. Louis



Clyde A Bland has had a successful year of outstanding leadership as national president

Delegates from NAPE subordinate associations discuss mutual and individual problems facing plant operating engineers, visit power show and elect new officers for 1944-45

▶At the Jefferson Hotel, St. Louis, Mo., National Association of Power Engineers held its 61st annual convention with approximately 170 delegates, 88 visitors and 77 exhibitors attending. At the last session the vice-president, Warren D Lewis, was elected president for the year 1944-45.

Mr Lewis, one of New York City's outstanding engineers, is chief engineer and building superintendent of the Hotel New Yorker. He is a registered professional engineer in both New York and New Jersey and holds an electrician's and first-class stationary engineer's license in New York City. His entire career has been marked by continuous study and personal development, which have enabled him to meet every responsibility with success.

After graduating in 1910 from Pratt Institute where he studied electrical and mechanical engineering, Mr Lewis started work in the motive power department of the New York Central RR. but continued his education with specialized night courses at Pratt Institute and Brooklyn Polytechnic Institute.

Following a well-organized plan to gain wider experience, he worked for the Bush Terminal and Brooklyn Edison Co before going with the Bradstreet Co. After five years service with Bradstreet, he became assistant chief engineer of the Metropolitan Life Insurance homeoffice building in New York City.

30 Years in NAPE

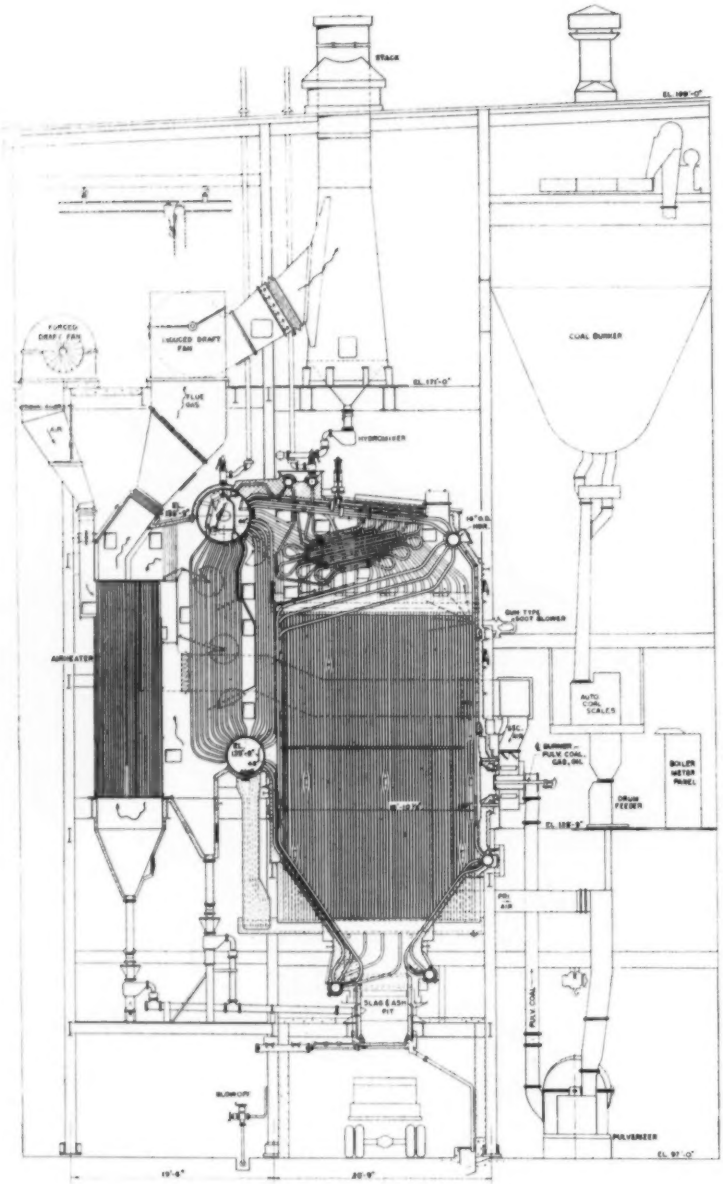
After eight years in this position Mr Lewis was appointed chief engineer for the Hotel New Yorker, which was then being erected. He followed the installation of all power facilities and equipment, checked all tests as the various machines went into operation. Besides his duties at the Hotel New Yorker he served as engineering consultant for the National Hotel Management Co while it functioned. This position gave him supervision over seven hotels in various cities, one being the Adolphus Hotel, Dallas, Texas, in which he installed air-conditioning equipment for 250 guest rooms.

Mr Lewis has been a member of NAPE for the past 30 years, during which he served as New York State president, president of Brooklyn Association No. 8, national chairman of the defense committee, and first chairman of the metropolitan district committee, now composed of delegates from the greater New York associations, No. 1, 24 and 44.

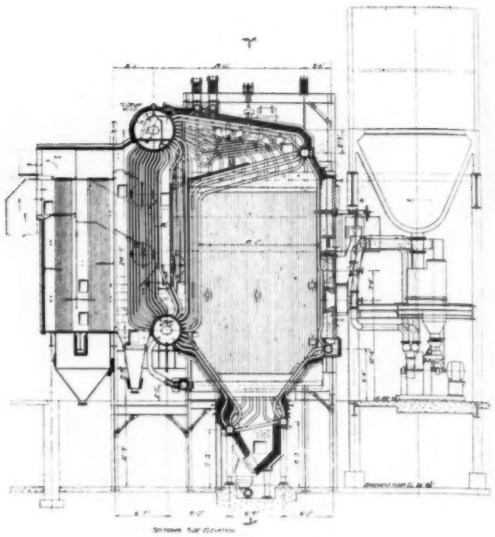
A member of Greater New York Association No. 1, Mr Lewis has been one of its most constructive leaders and has always worked in the interest of and helped promote the aims of NAPE. He has done outstanding work in the educational program of his association and is a strong advocate of closer contact between neighboring associations through individual member visits. He is also a member of the Montclair, N. J., Society of Engineers

(Continued on page 98)

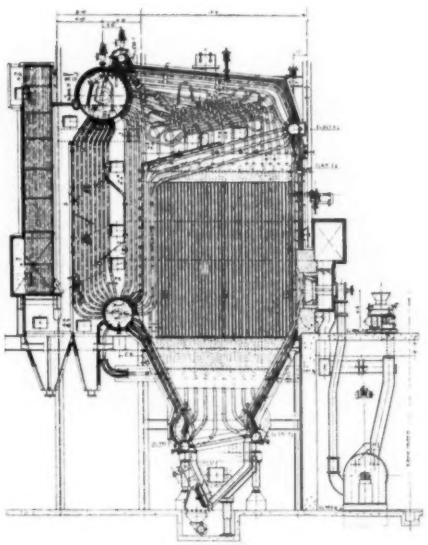
Typical recent installations of



ALTON BOXBOARD COMPANY, Alton, Illinois
110,000 lbs./hr. Riley Steam Generating Unit
550 lbs. Pressure – 750°F. Temperature
Pulverized Coal Fired – Efficiency 85%



KELLOGG COMPANY, Battle Creek, Michigan
120,000 lbs./hr. Riley Steam Generating Unit
725 lbs. Pressure – 750°F. Temperature
Pulverized Coal Fired – Efficiency 86.2%



AMERICAN VISCOSE CORPORATION, Nitro, W. Va.
90,000 lbs./hr. Riley Steam Generating Unit
600 lbs. Pressure – 750°F. Temperature
Pulverized Coal Fired – Efficiency 85%

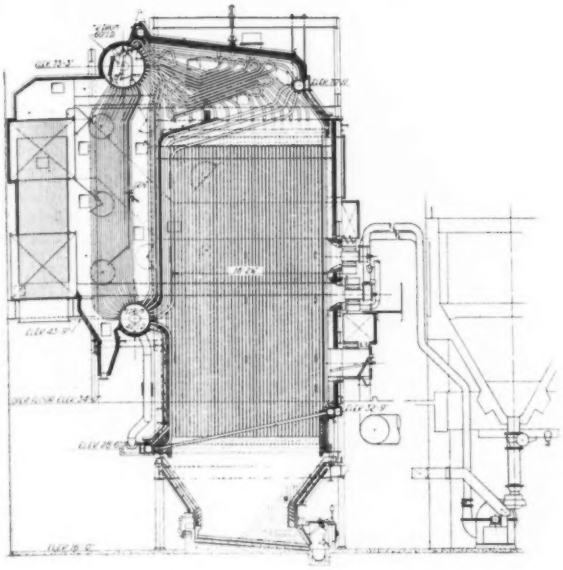
RILEY

STOKER CORPORATION, WORCESTER, MASS.

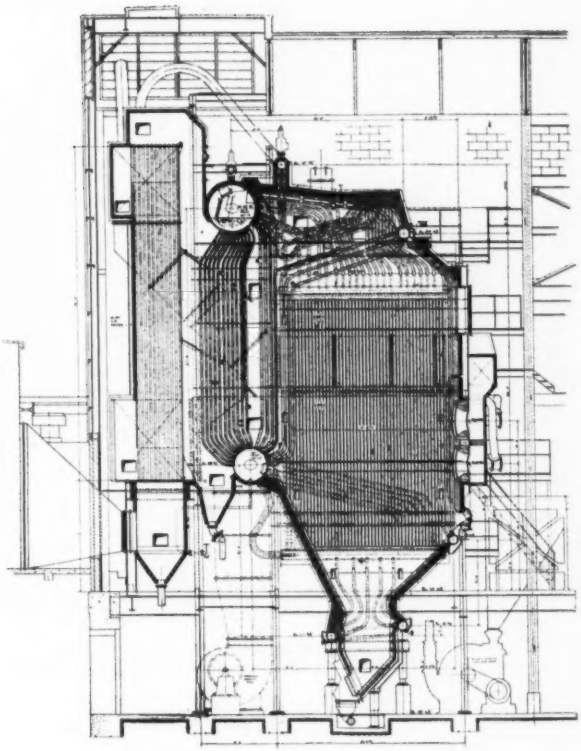
Boston New York Philadelphia Washington Buffalo Cleveland Detroit Chicago St. Louis Cincinnati
St. Paul Kansas City Denver Seattle Portland Los Angeles Houston New Orleans Atlanta Memphis

It will pay you to visit modern Riley Installations

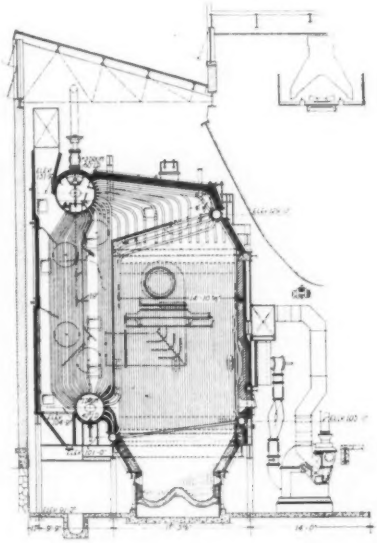
moderate sizes of boiler units



REPUBLIC STEEL CORPORATION, Cleveland, Ohio
175,000 lbs./hr. Riley Steam Generating Unit
350 lbs. Pressure – 700°F. Temperature
Pulverized Coal and Blast Furnace Gas Fired
Efficiency 78.2% when firing with B. F. Gas



N. Y., N. H. & HARTFORD R. R., Cos Cob, Connecticut
150,000 lbs./hr. Riley Steam Generating Unit
375 lbs. Pressure – 577°F. Temperature
Pulverized Coal Fired – Efficiency 86.2%



SWIFT & COMPANY, Chicago, Illinois
100,000 lbs./hr. Riley Steam Generating Unit
300 lbs. Pressure – Saturated
Pulverized Coal Fired – Efficiency 84.5%

All These Well Known Companies Installed Riley Boiler Units

The six typical moderate sized Riley Steam Generating Units illustrated are good examples of the character of installations being made by Riley in so many of the leading industrial and central station plants.

Complete satisfaction with outstanding economical results has resulted in a most decided swing to Riley. Be sure to make a thorough field investigation of Riley boiler units before purchasing steam generating equipment. It will pay you well to do so.

A survey of your power plant by a consulting engineer will possibly show ways of making surprisingly large savings in power costs

COMPLETE STEAM GENERATING UNITS

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS
ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD INSULATED SETTINGS • AIR HEATERS

before purchasing Boiler or Fuel Burning Equipment

Power Engineers Convene in St. Louis (*Continued from page 95*)

George E Wills, of Kansas City, Mo., is elected vice-president for 1944-45

Hard-working members of the 61st convention committee (standing) meet with national officers (seated) to make final arrangements for the convention facilities

and a member of the American Society of Mechanical Engineers.

Clyde A Bland, who concluded his term as national president, is general superintendent of gas production of Iowa Power & Light Co.'s Des Moines plant. He is president of Midwest Gas Association and chief of staff for utilities and railroads on the Civilian Defense Council for Polk Co, Iowa. Included in his activities is membership in Des Moines Chamber of Commerce, American Arbitration Association, Universal Craftsmen Council of Engineers.

Other officers elected are: vice-president, George E Wills, Kansas City, Mo.; secretary, A F Thompson, Chicago, Ill.; treasurer, Harry J Harp, Manchester, N. H.; conductor, C E Exbom, Chicago, Ill.; doorkeeper, Eugene Bishop, St. Louis, Mo.; board of trustees, C A Nelsen, Minneapolis, Minn.; board of arbitration, F C Laufketter, St Louis, Mo., J F Carney, New York, N. Y., D G Kimball, Dorchester, Mass. The delegates voted to hold the next convention in Cleveland, Ohio.

Highlights of Sessions

The first session, called to order by past national president, Fred C Laufketter, featured addresses by Commissioner Skinker representing A P Kauffman, mayor of St Louis; national president, C A Bland; Mr Hedges of the St Louis Convention Bureau; and national vice-president, Warren D Lewis.

In addition to many committee reports and discussions concerning work being done by the association, several meetings were devoted to educational subjects. Highlights of the latter were: the Navy motion picture, "Behind Nazi Guns," together with talks from several members of the armed forces who saw service in France and the South Pacific, introduced by Lieutenant Douglas K Porteous, USNR; industrial application of electronics, by Fred Hickman, Westinghouse Electric & Mfg Co; and an illustrated talk on firing pulverized coal in large industrial plants, by Jesse Best, chief operating engineer, Anheuser-Busch, Inc.

The power show attracted considerable attention and kept the delegates occupied between sessions. About 77 manufacturers and supply companies exhibited new products and distributed technical literature to visitors.

Delegates assembled in the Jefferson Hotel's Gold Room for the convention meetings.

Photo, courtesy of A W Sanders

The Economic Reconstruction of Europe

THE time is fast approaching when allied and enemy populations alike will demand a blueprint for the economic reconstruction of Europe. The peace plans following this World War will be written piecemeal, and by experts, at a series of continuing conferences, such as Hot Springs, Bretton Woods, Dumbarton Oaks and Quebec, each tracing a new pattern for negotiation and each dealing with a single, specific problem. In the drawing of these plans, the United States, as owner of more than half of the world's industrial capacity, controller of the only great credit reservoir, and possessor of the largest force of highly skilled technicians and management engineers, has heavy responsibilities which its industrial, financial, agricultural and labor leaders cannot evade.

☆ ☆ ☆

Just what is the problem which the world's business leaders must help solve in Europe?

The best safeguard of peace is economic opportunity—a good chance for all peoples to raise their standard of living by their own ingenuity, foresight and industry.

Frustrated and disappointed peoples, who view the future with misgiving rather than hope, breed fanatical demagogues who seek to divert nations from their ills and disappointments by promising military glory and conquests.

Consequently, an important step in building a secure and lasting peace is to open the doors of opportunity to the peoples of Europe.

The greatest obstacle to opportunity in Europe has been economic nationalism.

The economic tradition of the Continent always has been highly nationalistic. The national feeling generated by the first World War, and the political autonomy conferred upon many peoples by the peace treaties, led to a great growth of economic restrictions. This trend was accentuated by the depression and by the military plans of the Fascists and Nazis. Hitler had to show his people they could be fed even if a blockade was imposed again. The inevitable result of these influences was to carry self-sufficiency to tragic extremes.

Economic nationalism holds down the standard of living of Europe in two ways:

1. It prevents the rise in most European countries of low-cost mass production.
2. It operates against an efficient geographical division of labor, preventing nations from doing what each can do best.

Great machines require great markets. One great machine of which the United States has many and Europe few is the continuous strip steel mill. At the outbreak of the war we had twenty-eight such mills of various sizes, England but one, and Continental Europe one. A building containing one of these machines is more than a quarter of a mile long and the minimum cost of the mill is almost $25,000,000. Only the prospect of a mass market justifies production on this vast, but highly economic basis.

The wasteful geographical distribution of production is shown by the agricultural policies of Italy, France and Germany.

In the 1930's, when lard sold for less than 8¢ a lb. in the United States, it cost 32¢ a lb. in Germany. In Italy and Germany imports of wheat were banned and its production at home was heavily subsidized. By the middle of the 1930's, wheat sold for $1.55 a bushel in France, $1.97 in Czechoslovakia, $2.29 in Germany, and $2.47 in Italy. At the same time the United States and the other efficient world producers and exporters (Canada, Australia and Argentina) were *restricting* production and were unable to average more than about 75¢ a bushel for their wheat.

Economic unity in Europe must ultimately mean a freedom to trade not greatly different from what we have within the United States. Given economic unity and the large markets which go with it, efficient mass production will develop. With Europe receiving cheap supplies of such staple foods as wheat, pork, lard and dried fruits from overseas, European farmers can prosper by specializing in producing fresh foods—butter, cheese, eggs, fruits, vegetables.

Then European agriculture will be more prosperous producing its specialties, and our agriculture (and that of the other great efficient surplus-producing countries as well) will have greatly expanded markets for our staples.

With a cheaper food supply for Europe—yet one yielding a better price for our agriculture—European labor will live better. Labor now used uneconomically for agricultural production will be released for industry. With big machines and semi-automatic processes European labor can produce more steel, automobiles, furnaces, plumbing and electrical appliances to advance its standard of living in coming decades, as the United States has done in past decades.

A rising standard of living in Europe will bring

Europeans to view peace with optimism and hope. And world trade grows as confidence and prosperity widen.

☆ ☆ ☆

How would a Europe which possesses economic unity appear to us on this side of the Atlantic?

It would be a prosperous Europe that would have strength in its advancing industries, but as the single great agricultural deficit area of the world, it would be dependent upon overseas supplies for vital agricultural staples. This dependence upon overseas agricultural supplies would be greatest for industrial Germany. Some people believe that a strong Europe would be a threat to world peace. More important, however, is the fact that a strong and prosperous Europe would not be a frustrated Europe. It would have found a way to achieve a rising standard of living. Furthermore, a prosperous Europe would, economically, be a dependent Europe because, although the European industrial worker would use more and cheaper food, he would have it only as long as he maintained the peace.

A prosperous Europe would be of special advantage to American agriculture (if we do not keep on pricing ourselves out of the market) and of great advantage to American industry.

The British policy of buying agricultural staples from abroad, for example, made her, a nation of only 45,000,000, the purchaser, in 1937, of $250,000,000 of all kinds of agricultural products from the United States. In the same year the rest of Europe (exclusive of Russia), with a population of 325,000,000 purchased only $300,000,000 of our agricultural products. But with more sensible organization of its agriculture, Europe could be expected to buy more than one billion dollars of agricultural products from us.

By far the greatest market for an expanded European industry will be Europe itself.

For American industry, there will be growing markets in Europe as industry expands. Experience shows that the trade between different highly industrialized areas is large. This country's biggest export markets have been with its keenest competitors—Britain, Canada, Japan, France and Germany.

Before the war, Europe, with two and one-half times the population of the United States, had only one-sixth as many automobiles.

If Europe (exclusive of Britain and Russia) were to motorize proportionately, it would need 75,000,000 automobiles. With normal depreciation this would ultimately mean 10,000,000 cars to be produced annually to replace worn out cars.

If one still wonders about the immense number of things Europe might produce *for herself*, let him calculate the highway expenditures, the filling and repair station businesses that must be equipped and maintained; and the doubling of the steel production that would be required to make the automobiles themselves and to reinforce with steel even a moderate amount of additional concrete highways.

Another example is the electrification of Europe. With two and one-half times our population Europe's consumption of electrical energy would be 175 million electrical H.P., if the European worker were to have the advantage of as many H.P. as the American. Yet, just prior to the war, Europe's installed operating capacity was only about 40 per cent of this figure.

☆ ☆ ☆

What has been sketched for Europe is actually much more nearly a page from the economic history of the United States than it is mere prophecy about a desirable future for a Europe at peace. But how can it be achieved? And what is our part to be in helping to bring it about?

Economic unity can be provided for the sovereign states of Western Europe by the peace treaty or treaties adopted at the end of the war. The provisions for securing *economic unity* in Europe should specifically cover:

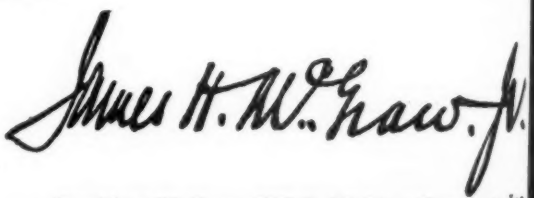
1. Substantial freedom for persons and enterprises to do business anywhere in Europe.
2. Reasonably free movement throughout Europe of persons for employment, recreation and education.
3. Greatly increased freedom of trade:
   a. Within Europe—through the application of a Europe-wide agreement reducing the tariffs among all European countries to a maximum of 10 or 15 per cent.
   b. With the rest of the world—through reduction of European tariffs on goods bought from overseas. This would call for generally lower levels on manufactured goods, and for the removal (after a reasonable period of progressive reduction) of tariffs on all agricultural foodstuffs and most industrial raw materials.
4. A special currency provision requiring as nearly as practicable complete currency stabilization for all countries of Western Europe among each other.
5. Creation of an agency (with adequate revenues) through which all Europe-wide business and other affairs affected by these agreements would be administered for a minimum period of twenty-five years.

This would permit the economic unity of Europe to be substantially achieved. During this period, assistance in administering the provisions would be given by officials of the United Nations.

Near the end of such a period arrangements could be made for a vote in the European countries on whether or not to continue the "unification provisions." If the vote were in the negative, the United Nations would have proper warning that additional safeguards would be necessary to prevent war.

The suggestions made in this statement aim at securing economic unification of Europe and thereby promoting the possibilities of permanent peace in Europe.

The realization of these possibilities throughout the postwar years requires a freely expressed public opinion in Europe to guide all who share the responsibility for bringing peace to Europe and to the world.



President McGraw-Hill Publishing Company, Inc.

Design Practice Can Make or Break A High-Speed Flat-Belt Drive

Operating above 5000 ft per min, a flat belt may develop faulty performance not present at lower speeds. F C Morton, chief engineer, Bickford & Francis Belting Co, explains the cause, and tells how rod-mill belt drives operate successfully at over 7000 ft per minute

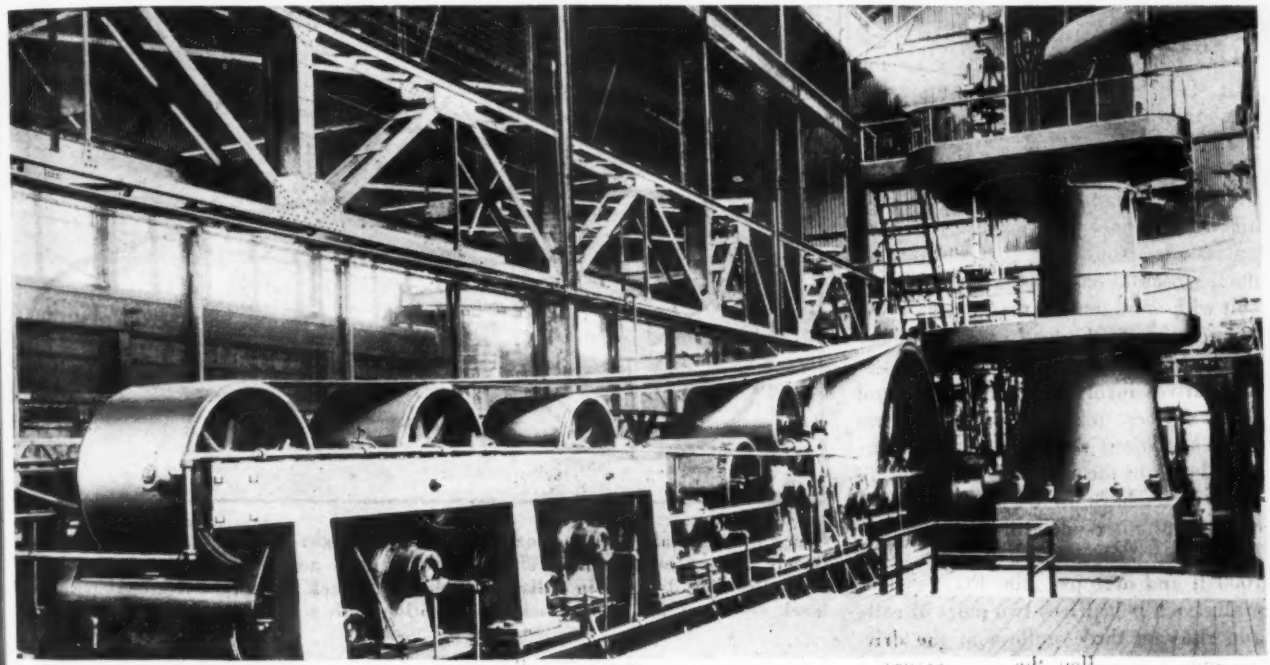


Fig. 1—Large corliss engine drives a rod mill through four belts on its flywheel. The under belt is 3-ply leather construction, 48 in. wide, and the three riders are double ply, 34 in. wide—all operating at maximum speed over 7000 ft per min.

▶WITHIN NORMAL SPEED RANGE, flat-belt performance follows a fairly definite pattern familiar to every operating engineer. But at high speeds, performance may change and serious difficulties develop. For belt speeds above about 5000 ft per min, relationship between centrifugal force, gravity and other forces that act on a belt becomes critical. Let us study these phenomena.

With slack side on top, a flat belt that operates with correct tension below 5000 ft per min takes a pattern similar to Fig. 2. Bottom belt strand, which is the tight side, runs practically straight, and top strand, which is the slack one, bows downward as shown. As load changes, belt strand shapes change slightly. At no load, both strands bow downward slightly. As tension in the bottom strand increases with load, it elongates. Bottom-strand stretch is transferred to the top strand, which tends to lengthen and sag more until at full load its form is similar to Fig. 2.

Centrifugal force tends to lift the belt at every point around the pulleys. Underneath, gravity tends to pull the belt away from them, and on top, it helps hold the belt down. For all practical purposes gravity may be considered constant, but centrifugal force increases as belt speed squared. Thus, at 5000 ft per min, centrifugal force acting to lift the belt off its pulleys is double that at 3500 ft; at 7000 ft, double that at 5000.

In other words, centrifugal force acting on a belt is four times as great at 7000 ft per min as at 3500. Up to about 5000 ft per min this force has little effect on belt performance. Above this speed, it reduces belt horsepower capacity rapidly so that at 7000 ft the belt can transmit only about the same power as at 3500.

As belt speed increases to 6000 or 7000 ft per min, a critical condition develops. Here the slack strand may leap and run away above its normal level until with a vigorous snap it jerks back to normal running position. Fig. 3 and 4 show what produces this effect in a simple high-speed belt.

Assume belt running smoothly at light load, as in Fig. 2, and apply a heavy load suddenly. Driven pulley momentarily slows down until the belt's tight strand stretches to where the prime mover supplies sufficient tension to drive the new load. During the instant that this is happening several things occur in the top strand.

When the driven pulley slows down momentarily, inertia of the top strand keeps the belt coming onto this pulley at original speed. At 6000 ft per min it approaches the driven pulley at 100 ft per sec, or 1 ft in 0.01 sec. Consequently, momentary slowing up of the

driven pulley tends to cause the belt to run ahead of it, as dotted lines *A*, Fig. 3, indicate. This action tends to slow up the top strand and decrease its tension. But the driving pulley continues momentarily to deliver belt to the top strand at its original rate and to reduce its tension still further.

Tension in the slack strand on the driving pulley's top side drops to where centrifugal force lifts the belt from this pulley, as the dotted lines *B* indicate. Wave formed at *B* is then carried along by the belt to the driven pulley so that the slack strand jumps to a position like that in Fig. 4. Then, belt contact with the driven pulley decreases to where the belt slips, restores slack-strand tension, and snaps back to normal. Belt grips the driven pulley with a sudden jerk to accelerate load to normal speed.

In general, this is what may happen in a simple high-speed belt drive. Usually it does not cause serious trouble unless conditions are favorable to producing oscillations. Then, operating the belt with more tension than normally required to drive the load greatly reduces or eliminates the trouble.

In drives involving idler pulleys and other devices, proper design can prevent oscillations that may cause serious trouble, as in the rod-mill drive, Fig. 5. Some drives have up to four belts riding one on the other—3000 lb of leather on the driving pulley with belt speed up to 7000 ft and over per min, Fig. 1. Generally each belt drives two pairs of rolls and runs on three pulleys at the driving end. One pulley, the idler, mounted on a swing frame with springs maintains belt tension. In some installations the idler may have rigid adjustment.

In the system of Fig. 5, consider the tension idler pulley with its shaft, bearings and swing bracket, a pendulum with a natural swing frequency. When springs are applied to the idler frame to maintain belt tension they, in combination with the idler mass, have an inherent frequency. As previously mentioned, the belt is elastic and according to its mass has a specific frequency of stretch and contraction. If the drive designer does not consider these frequencies they may be about equal, or synchronize.

When this happens, an impulse such as sudden load change may cause disastrous oscillation of the idler. The belt may continue to act as in Fig. 3 and 4 until it fails. I have seen more than one

(*Continued on page* 140)

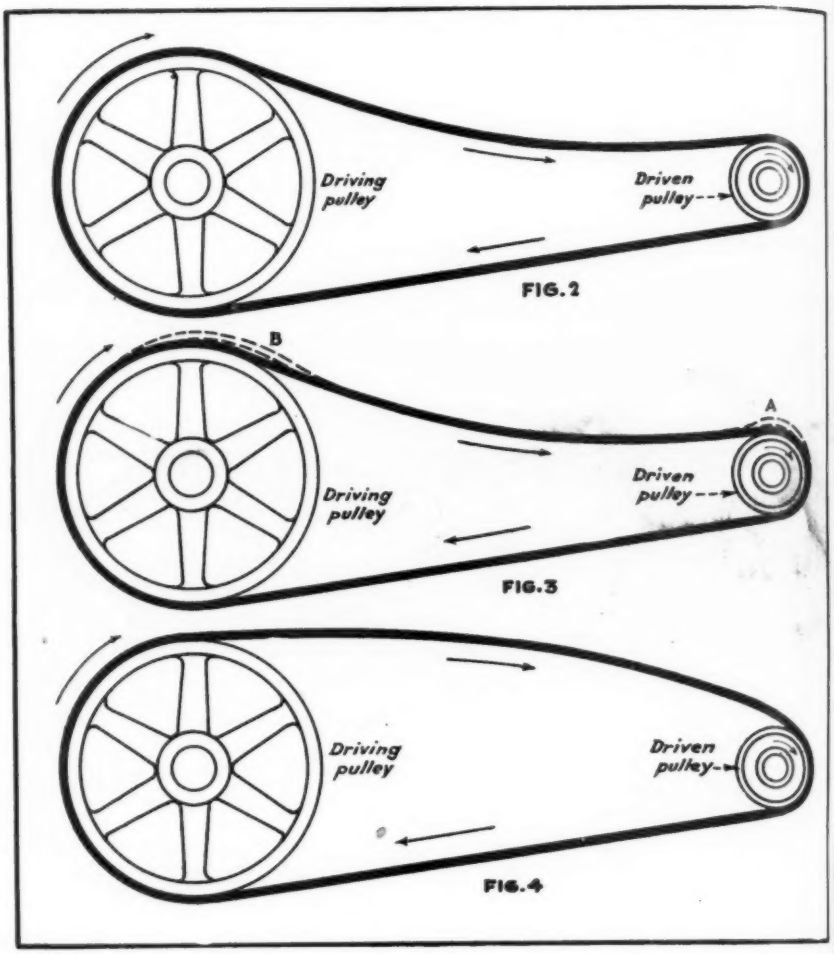


Fig. 2—At normal speed and load a flat belt with tight bottom strand follows a pattern closely resembling the lines shown here. Fig. 3 and 4—At high speed, a critical condition may develop in a flat belt where its slack top strand leaps above normal level, as shown, and snaps back into position with a sudden jerk

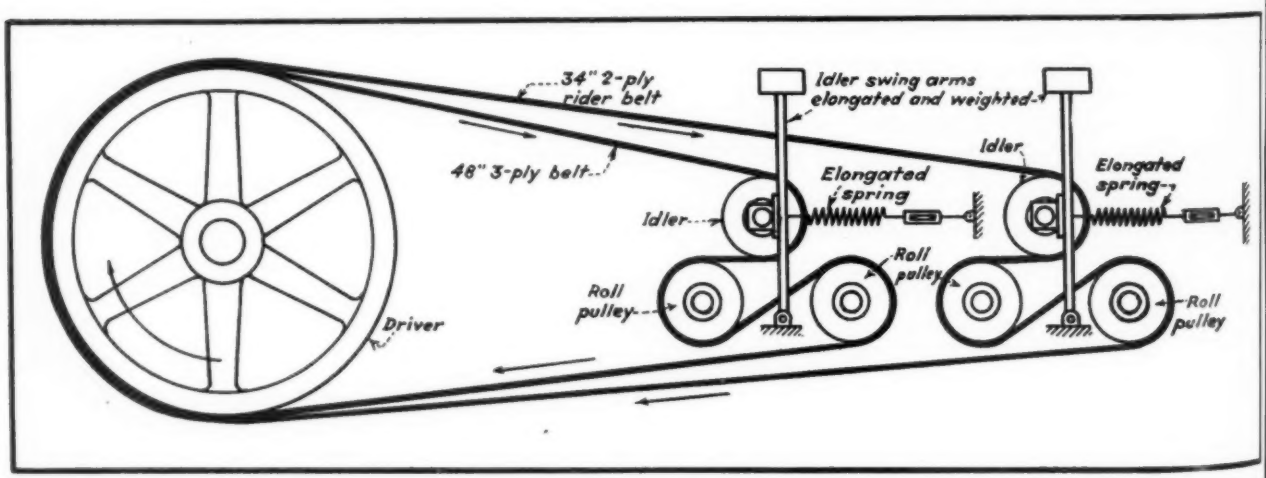
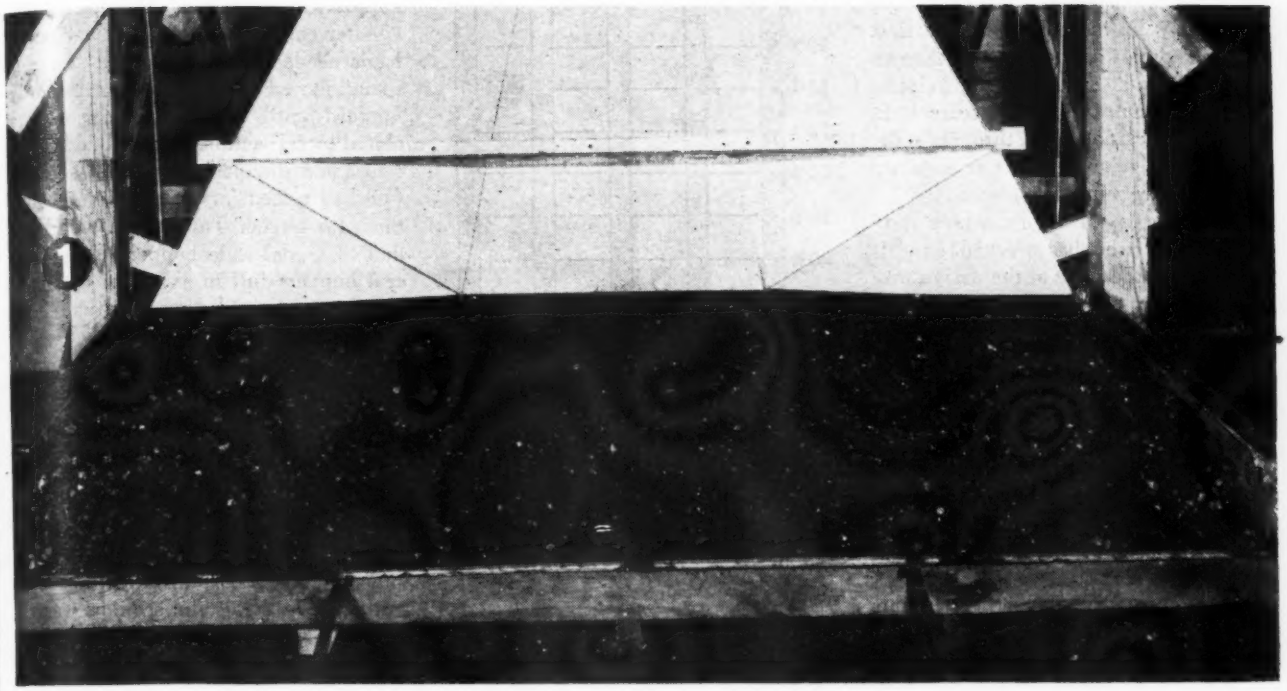


Fig. 5—Rider-belt drive with tension idlers arranged to eliminate oscillations that produce wave action in the belts



Is Modified Flat Chute Non-Segregating?

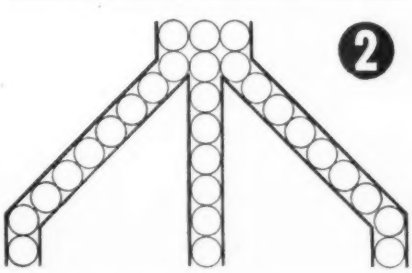
By ARTHUR J STOCK
President
Stock Engineering Co

EDITOR'S NOTE: Shortly after the article, "New Coal Chute That Eliminates Stoker-Hopper Segregation Is Easy to Make," by Philip B Richardson and Max R Boye, appeared in POWER, *August, 1943, Mr Stock questioned the effectiveness of the design and conducted tests with a full-scale replica of the chute. He then asked the editors of* POWER *for an opportunity to present his findings. We gladly accord him this privilege and the following statement outlines his views on the design, the test procedure followed, and the results.*

▶ THE ARTICLE "New Coal Chute that Eliminates Stoker-Hopper Segregation Is Easy to Make" proved quite startling because it claimed non-segregated fuel feeding from design that should segregate coal even more than a typical flat chute, according to our experience. Because the theory behind this design appeared to be in error, we decided on a careful investigation. Our findings are reported here.

The mathematics and explanations in the article are difficult to follow. Certain physical conditions appear to be taken for granted. For example, chute thickness varies as the secant of the angle *a*, between chute center line and side boundary line, which is 1.1274 and 1.1666 for two of the illustrations. This means that section depth at chute sides should hold that ratio to center depth. However, another part of the article states, "A good rule of thumb is to make depth of section at center about half that at sides." This corresponds to a value of approximately 2 for secant *a*, which is quite different from 1.1274 and 1.1666. The angle whose secant is 2 is 60 deg. A chute designed with this flare angle would be so short that coal would not flow through it satisfactorily.

The article also states ". . . rate of flow across the width (of the stoker hopper) stays nearly uniform because the stoker rams take away about the same amount of coal at each point." The authors here refer to the underfeed type. In these units, the ends of the hopper rise substantially vertically from the ram-box sides. In a typical case the width of stoker hopper that feeds a center retort is 21 in., whereas the width that feeds the end retorts is about 15½ in. The ratio of 21 to 15½ is 1.35, which is considerably greater than the secant of the chute angle in the article diagrams. In other words, the irregularity of coal demand caused by stoker feed mechanism proves to be a greater upsetting influence than the fact that coal at the outside of the hopper must travel a greater distance.



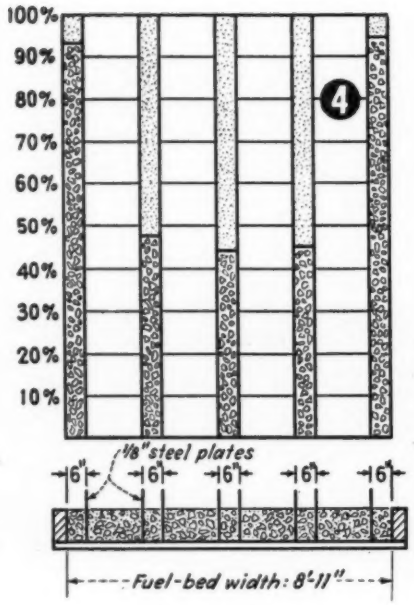
The proposed design rests on the theory that because coal moves to the hopper outside it travels a longer distance than coal at the center and, therefore, travels faster. The article says, "A lump in one stream, bordered by faster-moving coal on one side than on the other, tends to turn and roll toward the faster moving stream." There is nothing that proves that the outside streams move faster.

The article assumes that the coal starts at a common point and moves to the outside chute corner in the same time that coal moves down the chute center. If the chute were filled with balls restricted to definite paths, as shown in Fig. 2, and if balls were removed from three streams at a uniform rate, balls in the outside stream would not travel fas-

ter because they go farther. There would only be more balls in the line. This definitely indicates that the assumption of a difference of velocity within the chute may be incorrect. In fact, coal does not move through a flat chute in a straight line as is assumed in the article being considered.

The above is all theory, which indicates to one who has worked on this problem that the basis of the design proposed in the article is incorrect. To check these apparent errors, we built a full-sized chute from used plywood to the dimensions given in Fig. 3 of the article. This chute was arranged to discharge on a plywood board with sides, which was pulled forward much in the manner of a chain grate. The photograph, Fig. 1, reveals the resulting distribution of coal, coarse at the sides and fine in the center.

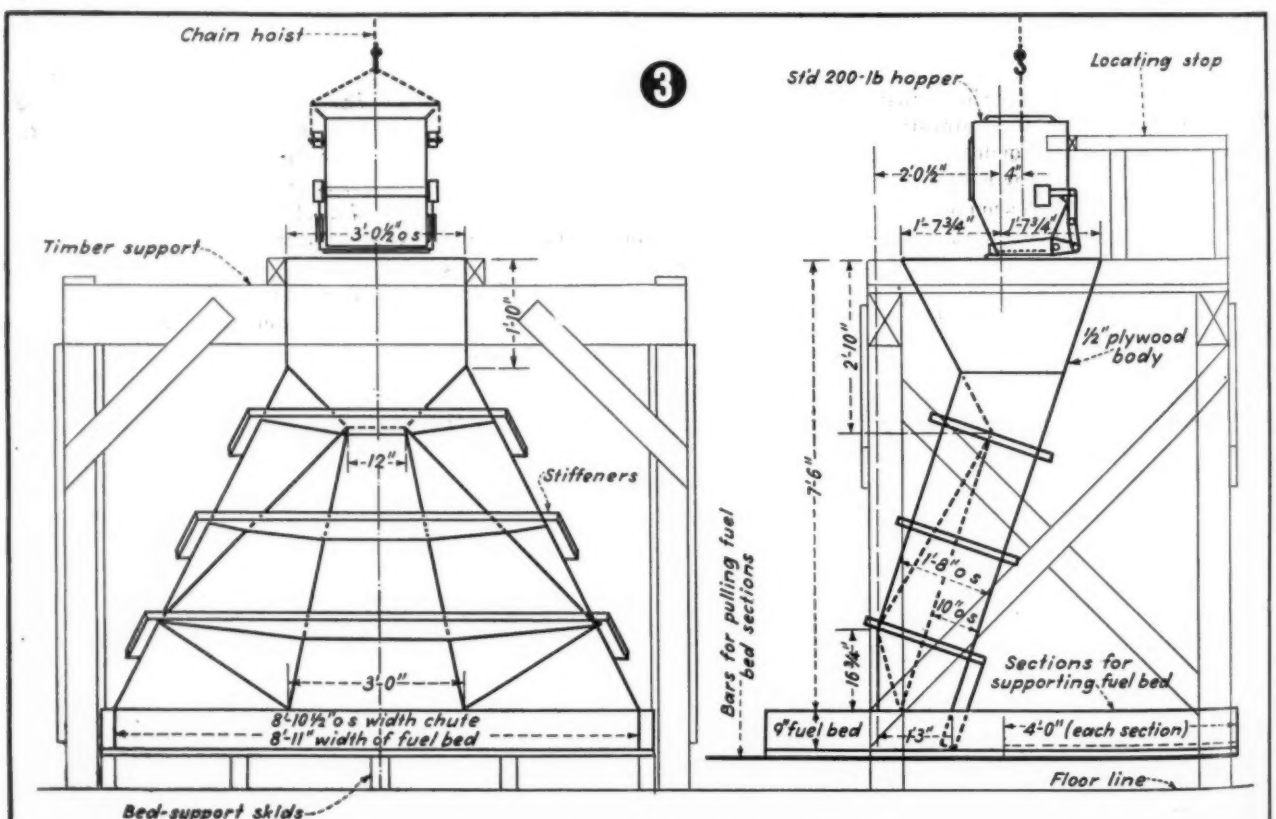
Fig. 3 shows clearly the test setup with the necessary timber structure to support chute weight and the external bracing to hold the chute together and support the coal weight. In all respects, the chute followed dimensions given in the article. To simulate a grate, plywood panels 4 ft wide, of a length equal to the chute width, were provided with end pieces of 8-in. plank. Suitable skids supported the bed panels at the height required to give a fuel-bed thickness of 9 in. When the panels were pulled forward slowly, coal was deposited in a uniform layer, in the manner of a chain-grate stoker.



Test coal was a mixture of three parts stoker slack and one part screened 1-in. size. Test personnel mixed this by hand and shoveled it into a standard 200-lb scale hopper fitted with a manually operated gate latch for dumping into the chute. An electric hoist raised each 200-lb coal bucket to the top of the test platform. The gate was tripped after the hopper was positioned by locating stops.

After counting the number of hopper loads needed to fill the chute, test personnel moved the fuel-bed panels slowly forward until the empty hopper gate closed by self action. The refilled hopper was again dumped in position and the fuel bed pulled forward as before until the gate closed. This action simulated that of a coal-scale hopper. When several hoppers full in excess of the number required to fill the chute had been dumped, the fuel bed was broken off at a joint in the bed panels. Photograph of this fuel bed (Fig. 1) shows that coarser particles had accumulated at the outer edges in proportions exceeding that at the center.

At this point, sliding thin steel sheets, 6 in. apart, edgewise into the coal provided samples at each end, middle, one-quarter and three-quarter points. Coal contained in these 6-in. sections was removed for a length of about a foot. Riddling each sample through a ¼-in.-mesh screen cloth separated coarse particles from fines. Each was weighed and percentage of coarse to fine calculated for plotting, Fig. 4. Results show that percent of coarse coal in three middle sections ran fairly uniform at 45%, with the two end positions showing about 93% coarse. Similar test of a conical nonsegregating chute revealed a maximum variation of 5% between samples.



THE OPERATING ENGINEER

George Edwards *Advisory Editor*

PRACTICAL AIDS · MAINTENANCE HINTS · QUESTIONS → ANSWERS

PUBLISHED MONTHLY AS AN INTEGRAL PART OF POWER

Timely Maintenance Makes Tiptop Heating Systems

In down-to-earth words and sketches for the operator, J D Constance outlines ways and means of keeping losses and other damages low so that a system absorbs maximum number of Btu and carries heat to its final destination

CLOSE INSPECTION of a heating plant and early repairs pay dividends in lower fuel consumption and better mechanical operation, or physical condition. In addition, first-class maintenance of equipment usually insures the desired spick-and-span appearance of individual parts.

Superficial cleaning during the summer shutdown—that is, removing ashes and wirebrushing accessible heating surfaces—is not enough. Many modern boilers have gas passes that the ordinary flue brush cannot reach effectively. Neglecting these channels permits soot and hard scale to accumulate and renders the areas almost useless for absorbing heat, Fig. 1. One-eighth inch of scale or soot on heating surfaces is equivalent to approximately four inches of rock wool insulation in ceilings and walls.

Start with Soot

If high-pressure steam or compressed air is available, use soot blowers on watertube boilers. Remove scale on the fireside of other heating surfaces with a scraper and then wirebrush until bright metal shows. A heavy-duty vacuum cleaner serves to advantage in summer cleaning.

Hold corrosion of the boiler's external surfaces to a minimum by spraying or brushing the exposed metal with discarded oil from automobile crankcases. Paint trimmings and other exterior surfaces with durable heat-resisting aluminum paint.

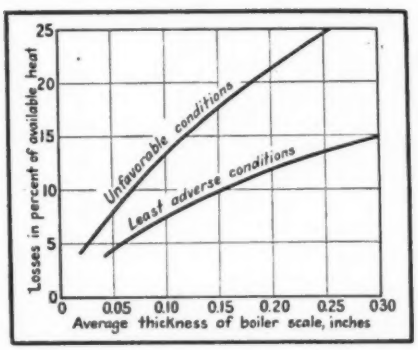


Fig. 1—Tightly adhering scale has higher insulating effect than loose soot

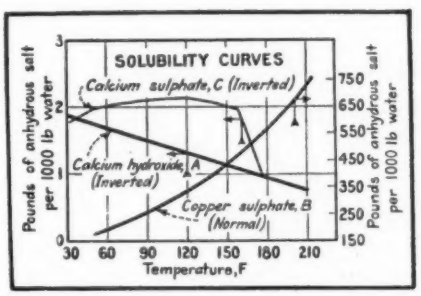


Fig. 2—Solids deposit on hot or warm areas according to their solubility

The waterside, however, requires more exact treatment. Shortly before the heating season closes, add cleaning compound to the boiler water and boil it in the system for a week or two; drain completely and flush until the water runs clean. Remove handhole covers and wash out remaining sludge. For the summer, add a small amount of cleaning compound to the water to make it alkaline, and fill the boiler to the top.

Prevent Scale

During operation it is important to render the boiler water noncorrosive and to convert hard, scale-forming salts to softer deposits that are more easily removed. When water is converted into steam, both the suspended and dissolved materials may deposit on the heating surfaces. Suspended matter may coagulate from increased temperature, or be entrapped by crystallizing soluble material. Soluble matter so deposited has an *inverted solubility characteristic* because, instead of becoming more soluble with an increase in temperature, its solubility decreases, Fig. 2, and it entraps suspended particles.

Since modern boilers are capable of evaporating their water content in as short a time as 15 min, it is readily seen that even well-softened water concentrates to the point where dissolved materials begin to precipitate. Thus calcium sulphate, having inverted solubility, deposits as an adherent scale on heating surfaces and as sludge in the cooler regions. If solubility increases with temperature, the material forms sludge in the hotter regions and scale

on cooler surfaces, such as economizers.

Water for steam generation may be treated both mechanically and chemically. Mechanical methods use distillation (evaporation) to separate dissolved solids, and non-volatile acids and deaeration to remove corrosive gases such as oygen, carbon dioxide and hydrogen sulphide. Chemical removal of hardness-producing ions—calcium, magnesium and, sometimes, iron and aluminum—is called softening. Water that contains few of these ions is called soft water. Best known are the lime-soda and zeolite processes.

Boiler water that is contaminated with oil from new boilers or from heating-system piping changes requires special treatment. Oil causes foaming and interferes with steam generation by increasing surface tension and entrainment. Boiling out the boiler with caustic solution or blowing down from the top until all traces of oil have disappeared solves the problem.

Boiler-water treatment should go hand in hand with effective elimination of accumulated solids by adequate blowdown. Blow high-pressure boilers down at least twice a day. Make periodic chemical hardness tests of boiler water to determine whether blowdown is sufficient. Equip the lowest point of boilers, headers and return lines with blowdown valves of adequate size to remove sludge as it accumulates. Use one 2-in. blowdown for furnace widths up to 12 ft; over 12 ft, use two outlets. Install two valves in series to prevent water hammer and leakage. Thus a set, made up of a quick-acting valve for safety and a slow-operating one for ordinary blowdown, serves the purpose.

Remove handhole and manhole cover plates on steel boilers and header caps of watertube boilers to examine the interior. Make periodic examinations, particularly at the end of each heating season. A turbine-driven brush may be needed to remove accumulation of hard scale, but use it sparingly because it abrades the metal. If boiler-water treatment is adequate, no hard scale adheres and the soft sludge may be hosed away.

If a steel boiler is to be filled with water while out of service, bring it to boiling temperature to drive out oxygen, which would accelerate corrosion. In hot-water heating systems, retain the same water from year to year. Drain and refill only for repairs. Fresh refill water contains more free oxygen than used water, which has had its oxygen content reduced by heating and venting.

Cover boiler's fireside with a protective coating of crankcase oil or rust-resisting paint. Thus moisture condensing on the cold surfaces will not corrode the steel during outage. Another expedient is to set a desiccating material, such as calcium chloride, inside the firebox to maintain a dry environment and thus reduce condensation. Inspect the chemical occasionally to determine its wetness; when it appears slushy, replace with a new batch because (1) desiccating power decreases with increased wetness and (2) hydrochloric acid forms by hydrolysis; its escaping vapor makes a corrosive atmosphere.

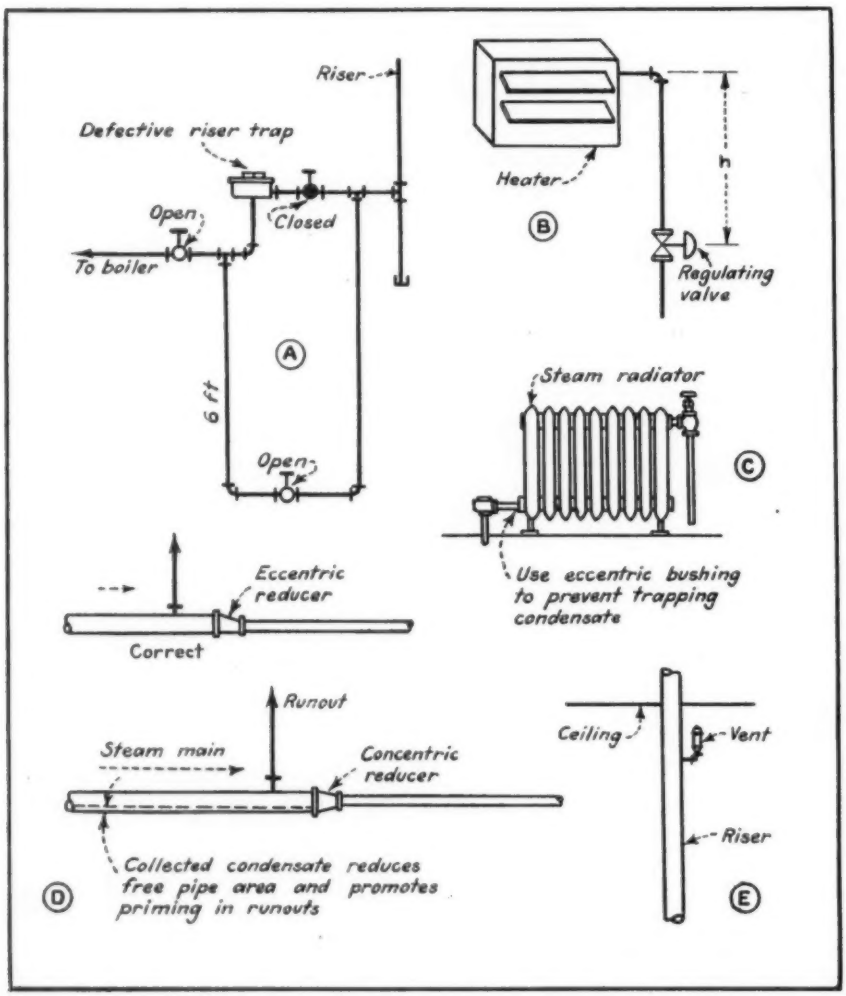


Fig. 3—*A*, easily installed pipe trap serves for faulty riser trap. Keep *h* short to reduce water hammer when inserting regulating valves in risers *B*

Regular Inspection

During the summer give heating equipment thorough inspection and make necessary repairs before the next heating season. Give brickwork, grates, tubes, breeching and safety devices particular attention. A standard check list offers one way to keep close watch on repair schedules. Test vacuum-steam heating-system drip-trap thermostatic elements in a test body. Every two years, test radiator-trap elements the same way, and replace defective units. Test vacuum pumps for vacuum-holding ability. If vacuum holds overnight the pump is tight. Repair all pipeline leaks.

Clean automatic-control or temperature-regulator systems and inspect for mechanical defects. Dirt and pipe scale or corrosion sometimes affect the free action of sensitive elements that make up the system. Repair leaks and vacuum clean air-conditioning and hot-air system ducts, following through to outside air-intake louvers and screens.

Clean stokers and dismantle all moving parts for inspection. Remove accumulated dirt adhering to forced- and induced-draft fan blades. Repair eroded areas by welding or brazing. Replace defective tuyeres. If high combustion rates burn tubes or erode furnace walls, increase the combustion space by raising the boilersetting and adding sidewall tubes. Continuous heat release of over 20,000 Btu per hr per cu ft of furnace volume may cause refractory failure, incomplete combustion, secondary

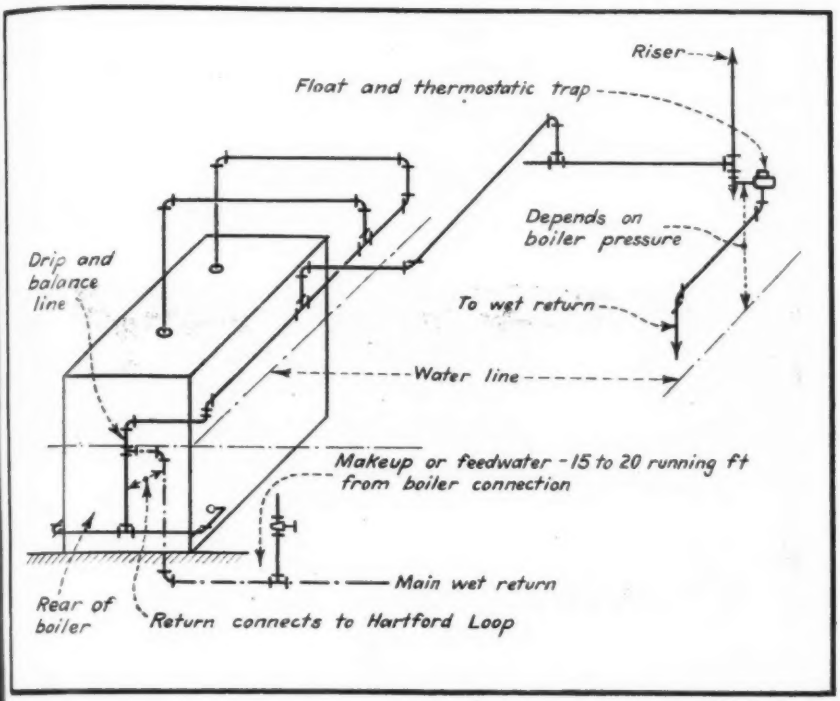

Riser
Float and thermostatic trap
Depends on boiler pressure
Drip and balance line
To wet return
Water line
Makeup or feedwater - 15 to 20 running ft from boiler connection
Main wet return
Rear of boiler
Return connects to Hartford Loop

Fig. 4—Hartford loop prevents emptying the boiler through a leak in the return line. Prevent boiler stresses by connecting feed line into wet return

combustion in afterpasses, confused boiler circulation and tube failure.

On oil-fired boilers, inspect oil burners, electrodes, nozzles, fan blades and pumps for erosion and leakage. Clean carbon deposits and sludge from all working parts.

Reduce losses from hot, exposed metal surfaces to a minimum by replacing defective covering on boilers, hot-water tanks and piping. Best mechanical results are obtained when insulation is reinforced with studs and wire.

Protect Insulation

Building operators who use high-pressure or purchased steam may find it profitable to cut heat losses by insulating building walls. Protect piping insulation exposed to weather against moisture penetration because it increases the material's conductivity and causes deterioration. Inspect control valves, reducing valves, regulators and traps for leakage frequently, and repair or renew working parts such as disks and seats, as needed.

Check steam circulation to various building sections occasionally to determine lowest pressure at which service can be supplied, and find time required to effect full circulation. Proper pitching of trapped lines and radiators, especially in single-pipe steam systems, and addition of quick vents at strategic points to remove air in pressure systems help accelerate circulation. Eliminating leaks helps circulation in vacuum systems, where it is important to maintain sub-atmospheric pressure. Such leaks are found most often in expansion joints, swing joints, radiator connections and valve bonnets.

Pipe trap *A*, Fig. 3, designed to hold condensate against the pressure differential, substitutes for a leaking riser trap until it can be replaced. When regulating valves are installed vertically, *B*, Fig. 3, keep distance *h* to a minimum or put the valve in the horizontal run to eliminate water hammer. After renovating, clean the openings in riser air vents, *E*, Fig. 3, because painters sometimes fill vents with paint.

A correctly designed heating system may be depended on to: (1) introduce feedwater into the return line instead of directly into the boiler (This prevents stresses in boiler shell.); (2) allow 24-in. between lowest point in steam lines and boiler-water level; (3) provide a Hartford loop to protect against emptying boiler through a leak in the return line, Fig. 4; (4) check blast-heater setting height against boiler pressure and total pressure drop in steam-line supply valve and blast coil, Fig. 5. Minimum distance of 24 in. from bottom of blast coil to boiler-water level usually serves for systems operating at 1 psi maximum.

Rise of water level in return line, *C*, is equivalent in static head to pressure drop from *A* to *B* and through the blast coil. Thus with 5 psi at the boiler, pressure drop through main and coils is 2 psi. Neglecting drop through the trap, pressure trying to lift water level is 5 psi; downward pressure is 5−2=3 psi, and the water level tends to rise 2÷0.43 =4.63 ft. Then water level is 4.63−2= 2.63 ft above bottom of coil. If the coil is placed in an outside air stream the water freezes. Maximum pressure drop in the supply line of 24÷12×0.43= 0.86 psi would just hold the water level below the coils. For a 2-psi pressure drop locate bottom of heater coils 4.63 ft above boiler water level to avoid flooding heater coils.

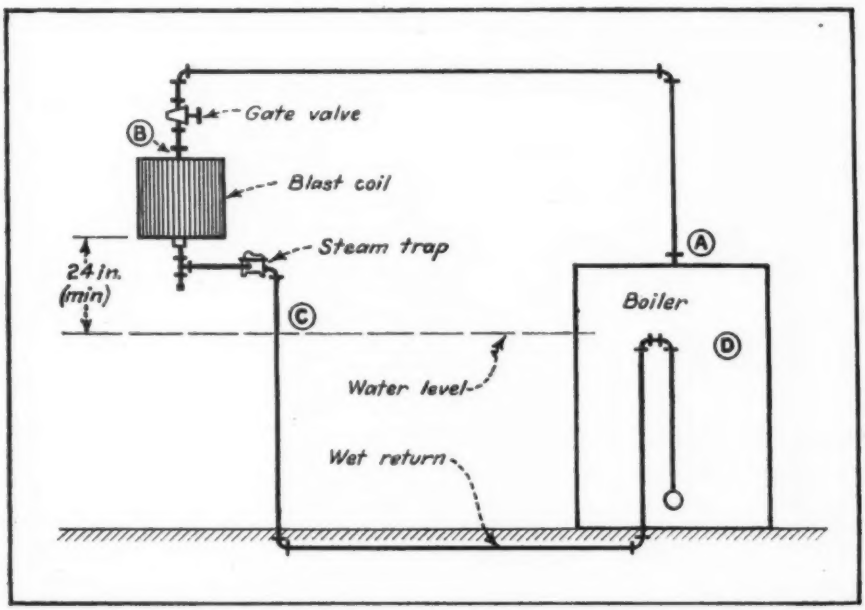
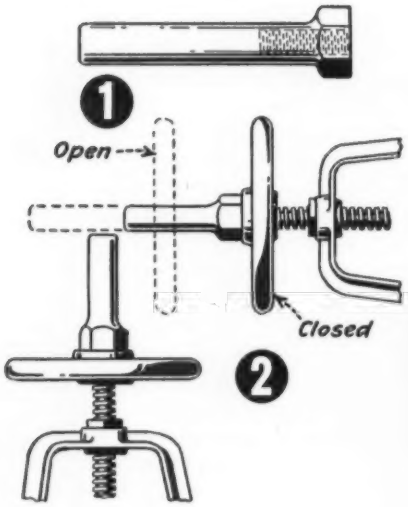


Fig. 5—Mount the lowest steam pipe or heater above boiler water level so condensate drains away from heater coils. Distance depends on boiler pressure

Plant-Tested Methods and Ideas for Power Men

PRACTICAL Aids

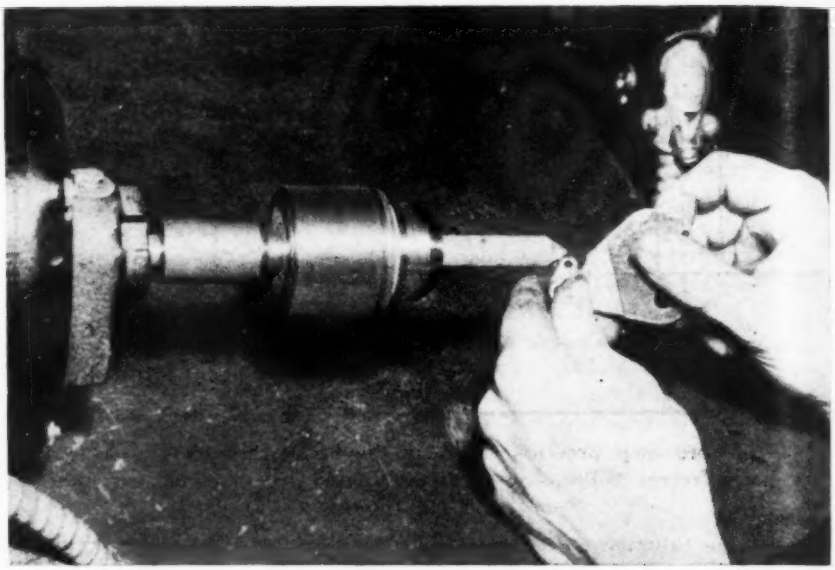


One Valve Locks the Other Closed

ON BOARD SHIP we have a standby pump for any one of several services. There is, however, the danger of incorrectly opening or closing the valves so that the pump is on the wrong service. The valves happened to be arranged at right angles so that if their valve stems were extended one set could not be opened unless the other was closed.

We therefore removed the valve-stem nut from each wheel and made an extension for each valve stem. Fig. 1. These were made from square stock turned round except for a short length at one end, which we used as a nut. This end we drilled and tapped to replace the nut on the valve stem. These extensions were installed as in Fig. 2 and as can be seen, when one valve is open the other must be closed.

Great Neck, N. Y. S M ELONKA



BURRING STONE FOR INACCESSIBLE SPOTS

A STANDARD CENTER LAP STONE is being used in a General Electric plant for burring operations which present a special problem of inaccessibility. Devised by Foreman D H Morrell, the tapered stone which can be reshaped several times, is used in a small bench motor and chuck or in a bench lathe. The new setup permits the complete and rapid burring of pieces with shoulders, counterbores and punched holes in locations where scrapers, files and wheels cannot penetrate. For example, when part of a boss or hub is cut away and a hole drilled through it, the stone is well adapted to burr the edges of the hole and of the cut-away section, as in the photo. Cost of these stones is small and each one can burr a large number of pieces. Since the stone is motor driven, operation is rapid.

Do a Two-fold Job by Avoiding Maintenance

PREVENTIVE MAINTENANCE is usually practiced to prevent unexpected breakdowns and avoid making repairs at inopportune times. It can, however, be made far more effective by practicing what we might call "prevent maintenance," that is, eliminate maintenance. If we strive to avoid maintenance, we are doing a twofold job: preventing breakdowns at any time and making preventive work less costly.

Here is what I mean: At a large steel plant we were doing a good job of preventing unexpected bearing failures by a careful inspection and overhauling schedule. We did a far more effective job, however, when we changed from sleeve to ball and roller bearings.

This change reduced bearing-maintenance man-hours to a fraction of what they were on our former preventive-maintenance schedule. Motors that had been checked two and three times a week were now checked twice a year. This was particularly true of motors on fast-moving machines.

To prevent delays in another plant, controls and mechanical auxiliaries of a roughly handled drive required daily inspection and repairs at every shutdown period. Changing this control to a quick-acting dynamic braking one with oversized contactors, reduced maintenance to week-end inspection and adjustment only. That's preventing maintenance as well as avoiding delays.

Initial cost of some of these changes might look high on the request order because maintenance of properly selected and installed electrical equipment is so small. Few managers are interested in spending money to further reduce this cost.

Unfortunately, electrical maintenance is often lumped into a general plant-maintenance charge. Unless this total charge sticks too far over the balance-sheet edge, little attention is given to any one department. High maintenance costs in one department sometimes pass unnoticed if they are offset by low costs in another.

Whether you supervise the maintenance in a mechanical, electrical or operating department, if you sell the idea

to Operation

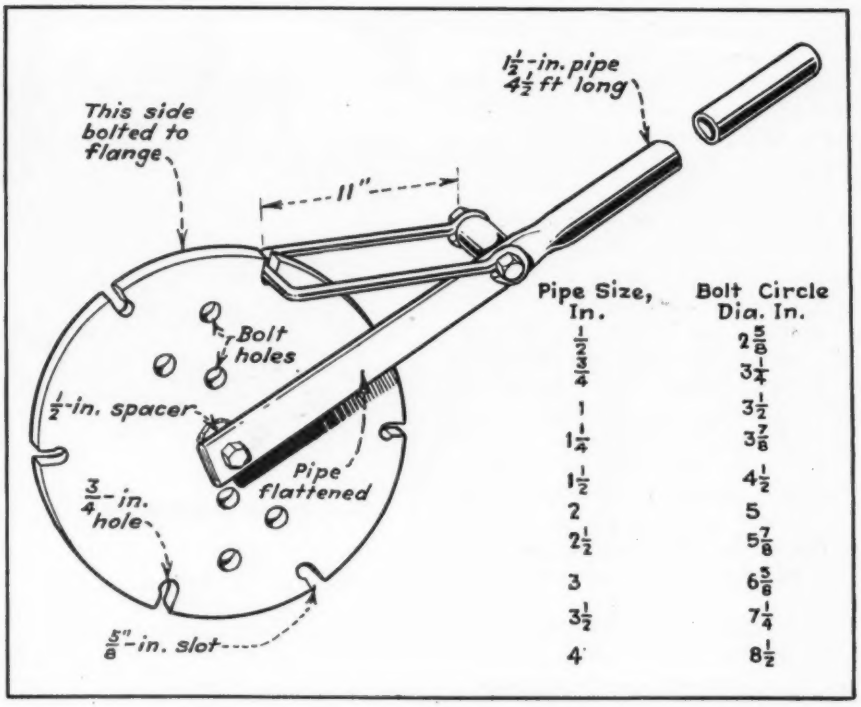
of avoiding the necessity of maintenance, you are doing real preventive work. Sounds suicidal, but a maintenance man should try to eliminate his own job, or should he?

Troy, N. Y. GILBERT LINDGREN
Electrical maintenance foreman, Hudson Valley Fuel Corp

Safe Wrench for Pipe Flanges

TIGHTENING FLANGES on pipe or removing them without proper tools is usually an awkward job. The job can also be hazardous if drift pins are placed in flange holes and tightening done with a bar placed between the pins, which is a common practice.

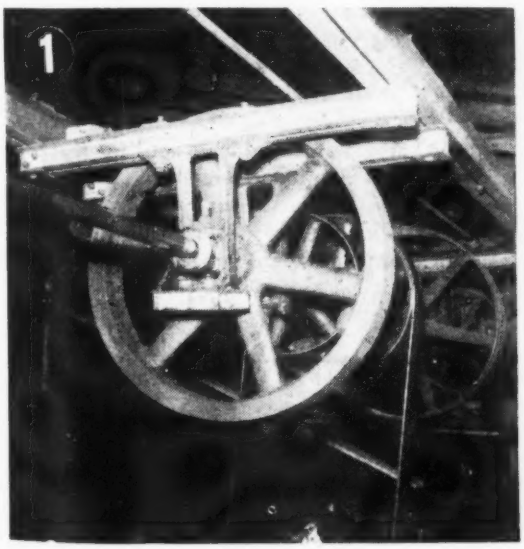
For a better and safer job, one company devised the flange wrench in the diagram. It consists of a ratchet-driven circular plate which bolts to the flange. Two holes are drilled in the plate for each size flange from ½ to 4 in.

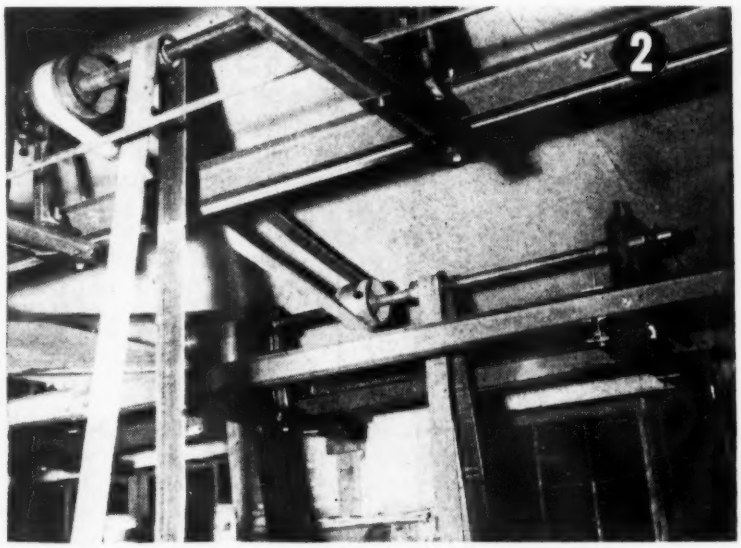


Pipe Size, In.	Bolt Circle Dia. In.
½	2⅝
¾	3¼
1	3½
1¼	3⅞
1½	4½
2	5
2½	5⅞
3	6⅝
3½	7¼
4	8½

Before using the wrench, screw the flange on the pipe hand tight. and bolt the wrench to it. Engage the ratchet arm and move the wrench arm clockwise as far as convenient. Then disengage the ratchet arm, return it to its original position and repeat the tightening.

Staunton, Va. B G SWITZER





FLYWHEEL TAKES PEAK LOADS OFF FLAT BELTS

IN OUR PLANT at Bristol, Tenn., we have a 7½-hp 1150-rpm motor belted to a lineshaft operating at 203 rpm, from which three sole-leather cutting machines are driven. This shaft belts to a jackshaft that drives another sole-leather cutter and also belts to lineshafts driving other machines. In this group drive, the sole-leather cutting machines were the unruly members. It was possible for their operators to trip all of them on at the same time. When this happened, lineshaft speed dropped seriously, the motor belt slipped and sometimes came off.

Both motor and its belt were too small for these sharp peak loads. We could have installed a larger motor and belt, but except for short periods during occasional peak loads they would have operated underloaded. This was objectionable because of low power factor and efficiency at which the motor would operate. Also, to take the peaks the belt would have had to operate at a much higher tension than to drive the normal load.

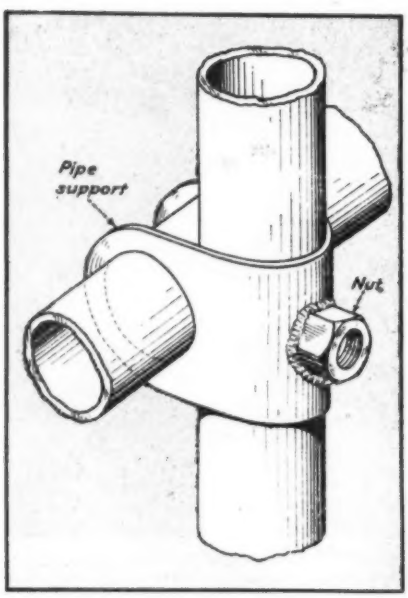
To correct the trouble caused by the

cutters and retain the 7½-hp motor and belt, we installed a 36-in. flywheel, Fig. 1, on the lineshaft near the center of the cutter load. By placing the flywheel at this location, shock load from the cutters is transmitted to it from both ends of the shaft. This reduces peak loads on the shaft to about one half of what it would be if the flywheel were located to one side of the cutter load.

We installed a bearing on the shaft at each side of the flywheel to give it ample support and hold the shaft in true alignment. This was easily done because all shaft bearings are supported on channel-iron stringers, Fig. 1 and 2, which permit installing a bearing anywhere along the shafting. The ceiling is low in one part of the room and we have installed the bearing above the stringers, as in Fig. 2, to get the shafting near the ceiling and save space.

The flywheel has eliminated the trouble caused by the sole-leather cutters and given smoother operation of other machines driven by the motor. The motor belt can operate with considerably less tension than before and does not slip on peak loads, all of which decreases its maintenance and probably doubles its life.

New York, N. Y. ROY C MOORE
Chas A Schieren Co



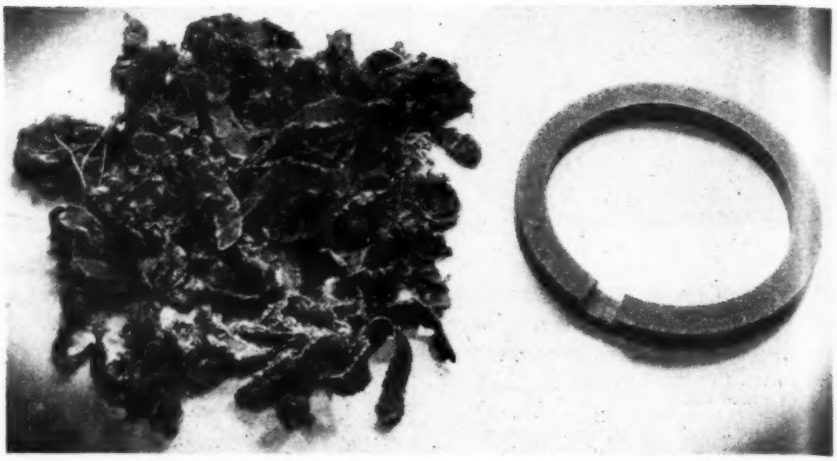
Makes One Pipe Support Another

WE HAD TO SUPPORT a free pipe on two vertical ones. The load was comparatively small, but its support had to be adjustable and look neat. After a few trials we decided to use sheet steel, as in the diagram.

With a hole saw we cut in the sheets two holes slightly larger than the outside of the pipe to go through them. Inside edges of these holes were spaced apart a distance equal to the outside diameter of the supporting pipe, plus one half its outside circumference. In the center of each sheet we drilled a clearance hole the right size for a ⅜-in. setscrew.

When the sheets were bent to shape we welded a nut around each hole. After assembling the horizontal pipe in the supports and properly locating it, we tightened the setscrews to bind the two pipes together. By using heavier sheet metal and more setscrews, larger pipe can be supported.

Brooklyn, N. Y. G STERLING GRAVES



PISTON PACKING PLUGS FEEDWATER LINE

PRODUCTS that have always been satisfactory may now fail suddenly because of wartime changes in materials or manufacturing processes, as a recent experience in our plant emphasizes. Our reciprocating feedwater pump had operated for many years with only normal attention.

Suddenly one day we made the alarming discovery that water level in the boilers was going down, with the pump operating.

One boiler was getting some water, the other none. We tackled the latter first and opened the strainer ahead of the feedwater regulator valve. This was full of rubber-impregnated tape. Practically similar conditions were found in the other feedwater-regulator strainer.

Putting a turbine-driven feed pump in service and getting boiler-water level back to normal we opened the reciprocating pump. Its piston packing was gone and this is what lodged in the strainers. On the right, in the photo, is a ring of the packing as installed and, on the left, what we took out of the strainers.

Natural-rubber compound originally used in this packing had been changed to synthetic. Some of the synthetics stand higher temperatures than natural rubber, but this one failed, either because of its characteristics or improper processing. We cannot hold the manufacturer wholly responsible because under present conditions he does not have time to get necessary experience with some of the changes he must make. On the other hand, it would help us operating engineers a lot if we knew that changes had been made in a standard product that might make its performance uncertain. We could then increase our vigilance at least until we were sure that the product would not fail suddenly. This experience serves as a warning that equipment now needs more careful watching than ever before.

New York, N. Y. FRANK SMART

Hidden Crack Causes Crankshaft Failure

THE HIDDEN CRACK in a shaft or other machine part has brought disaster to more than one capable operating engineer. No matter how carefully you follow an adequate inspection and maintenance program an unexpected failure due to a hidden crack dogs your steps. To come through without a serious accident when such a crack occurs in the crankshaft of engine or other machine, your lucky star needs to be shining brightly, as mine did once last winter.

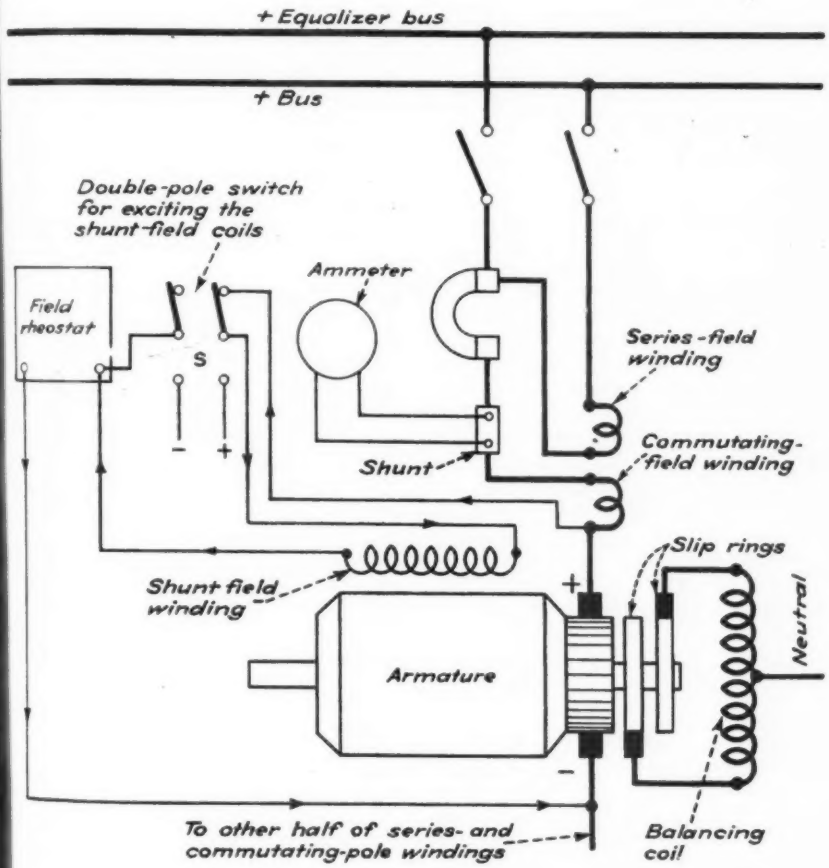
The night watch engineer phoned me that he had shut down the large corliss engine because it had developed a funny

knock. Inspection showed nothing wrong, but when the engine was started slowly its crankdisk began to wobble. One or two more revolutions and the crankshaft would have broken just inside the crankdisk, which at full speed would have wrecked the engine.

The crankshaft is about 15 ft long, 14 in. in diameter, supported in three bearings, two of which are outside the engine. Next to the engine is a large rope-drive sheave and beyond this, with a bearing between, a flat-belt flywheel with a bearing outside. The end of the shaft had been turned down to about 12 in. in diameter and one half coupling keyed to it. The latter, at one time connected to a lineshaft, is now out of use.

It was impossible to replace the crankshaft except on a long-time delivery, so we decided to rebuild the old one. We stripped the shaft, sent it to a machine shop, and turned the coupling down to the shaft diameter. This permitted us to shift the shaft far enough toward the engine to refit the crankdisk on it. The end of the old shaft had been turned down to 9.25 in. in diameter for the crankdisk. When rebuilding the shaft we reduced its diameter to only 13 in. and bored out the disk to fit. This gave greater strength at the disk where the shaft had failed before. By careful planning, hard work and the cooperation of a good machine shop we had the engine back in service in two weeks compared to a delay of months waiting for a new shaft.

Garfield, N. J. GEORGE MORELAND
Plant engineer, Hammersley Mfg Co



CORRECTING REVERSED DC POLARITY

BECAUSE OF FAULTY PARALLEL OPERATION of two 3-wire dc generators we had trouble equalizing the load between them. At times when the operator was away from the switchboard, one machine would take all the load from the other and sometimes motorize it, causing reversed polarity.

To correct the polarity of the motorized machine we removed its brushes from their holders and closed the machine's switch to connect it to the other one. This excited the machine's shunt-field winding in a direction to give the field poles correct polarity. When doing this there was always the danger that carbon dust might lodge between a brush-holder and commutator to cause a flashover. The hazard also exists of a brush on two brush-holders touching the commutator and causing a short circuit. We therefore abandoned this method in favor of disconnecting the shunt-field winding.

This required considerable time as did removing the brushes, so we used a double-pole double-throw switch as in the diagram, *S*. When this switch is in its up position the shunt-field winding is connected to its rheostat in the usual way. Throwing the switch down connects the shunt-field winding directly across a separate source of power. The polarity of this power source is the same as that of the generator so that the field polarity is corrected on the first trial.

Ottawa, Ont. JOSEPH BONGIORNO

Drip Drain Keeps Boiler Front Clean

WATER-LEVEL TEST COCKS are a source of rust streak and other objectionable conditions on firebox boiler fronts. To eliminate these the fireman in one plant installed a sheet-metal drip collector below the cocks, as in the photo. He tapered in the collector top so that only a narrow slot remained open for the drips to enter.

The collector supported on the two end cocks was placed so that it did not prevent the fireman seeing water coming from all three cocks. In the lower end of the collector he soldered a ¼-in. nipple that connects to a drain pipe to carry away the drips. This simple trick contributes much to keeping the boiler tidy, an important feature in plant operation.

Pomona, Calif. G M WILSON

READER'S PROBLEMS

Exercise your engineering wits by submitting answers to these questions fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

Questions from Our Readers

QUESTION 1

Why Doesn't This Shock Absorber Work?

WE OPERATE three oil cylinders with a trip mechanism on each to reverse the piston. When the trip operates it produces a surge on oil line and pump.

To eliminate this shock we installed a 1½-in. by 4-ft. air chamber on each 1-in. line feeding the cylinders. Chambers connects into the bottom of each line through a ½-in. drop loop. Chambers work satisfactorily when installed but the air cushion soon disappears. Oil operates at 120 F and 100 psi.

How far does the oil rise in these chambers? Would operation be more satisfactory if they were connected into top of oil line? Should their size bear some relation to the pump or cylinder capacity? If so, what do you recommend for the design formula?—*RA*

QUESTION 2

What Is the Correct Receiver Pressure?

CHANGING WATER TEMPERATURE through different seasons of the year varies the vacuum on our cross-compound corliss pumping engine. Pumps are flywheel plunger units.

With lower vacuum should a corresponding change be made in receiver pressure? What is the best way to adjust this pressure? Some engineers do it by adjusting the high-pressure cutoff while others adjust the low-pressure cutoff. I would appreciate hearing how other POWER readers make adjustments so that the load between the cylinders is equalized—*ACC*

Answers to August Questions

Is This Blowdown Piping Satisfactory?

(This is Question 1 from the August issue, with best answers from readers.)

Blowdown piping on our boilers is arranged with one set of valves beyond the two branches, as sketched [August POWER, p 110]. *Is this correct, or should two valves be inserted in each branch line?*

If we must rearrange the piping, can we use two slow-opening valves instead of one slow-opening and one quick-opening valve? What purpose is served by a quick-opening valve when we are cautioned to open it first and close it last? What alternate arrangement is safe and practical?—BW

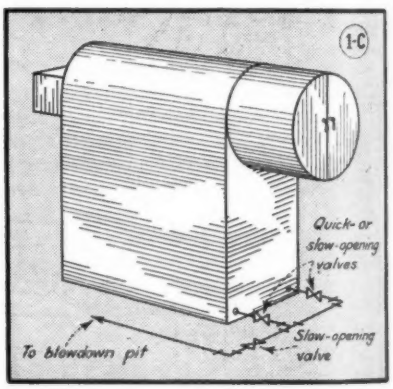
More Uniform Sludge Removal

BLOWDOWN PIPING arrangement on BW's boiler does not conform to ASME Power Boiler Code. In general, the code calls for an extra heavy valve or cock on each bottom blowoff line. Two valves or a valve and a cock are preferred. This applies only to existing installations. On new units where the allowable working pressure exceeds 100 psi, two slow-opening valves, or a slow- and a quick-opening valve, are required in each bottom blowoff pipe.

On a boiler having multiple blowoff pipes, a single master valve may be placed on the common blowoff pipe from the boiler. Here only one valve on each individual blowoff is required.

BW can improve his arrangement and make it conform to ASME Code by using an additional valve and changing the piping as in 1-C. Put either a quick- or slow-opening valve in each line from the boiler with a single master valve (slow-opening) in the common blowoff line. In addition to complying with code requirements, this arrangement allows the operator to blow each line individually and thereby get more uniform sludge removal from the bottom of the boiler.

Brooklyn, N. Y. *John Salviani*



Causes Unequal Flow

BLOWDOWN VALVES as presently installed on BW's boiler are incorrectly arranged although the lines themselves follow good boiler operating practice. Assuming that the boiler operates above 100 psi and that it is located where ASME requirements prevail, the arrangement does not comply with Paragraph P-308(a) and a competent boiler inspector will surely request rearrangement because this rule calls for a valve or cock in each blowdown line. The boiler is equipped with two blowdown lines, each of which is affected by the ASME requirement.

Ordinarily these boilers are equipped with a single blowdown connection attached to the bottom center part of the

water leg instead of having one at each corner. However, since BW's boiler contains two blowoff pipes it is not necessary to install two valves on each individual line. Requirements may be met, Paragraph P-311(a), by installing a valve or cock (single) on each individual branch and a single master valve on the common blowoff line beyond the outboard tee connection. The master valve or individual valve or cock must be slow opening.

Another reason why the original hookup is not satisfactory is that it is impossible to effect proper blowdown. When the valves on the common line are opened the line nearer the valves receives bulk of flow. With individual valves and cocks as required by the Code, proper cleaning can be effected by blowing down each individual connection separately.

Only purpose of the quick-opening valve is a secondary safeguard to back up the slow-opening valve and to offer a double seal when the connections are closed under normal operation. Slow-opening valve is the one with which the blowdown operation is carried out, and which takes all the wear.

Since the other valve serves only as a safeguard, the Code permits a quick-opening valve, which can be opened and closed without undue loss of time. For added safety I suggest that BW eliminate the abrupt 90-deg turn in the common line between valve and blowdown tank. A long radius bend would suffice.

Long Beach, Calif. A R CIOTTI

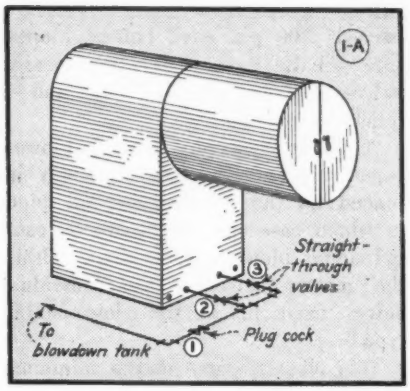
Only One Blowdown

BOILER SHOWN has been furnished in various sizes for our Armed Forces. Since they were produced in quantity and were to be fired with various fuels, they were equipped with two blowdown openings in the throat sheet. This enabled convenient blowdown connection when an oil or gas burner was installed to fire through the throat-sheet wall of the furnace. One opening is sufficient.

Kewanee, Ill. C E BRONSON

Explains Blowdown Procedure

I DO NOT LIKE BW's valve arrangement because one line may take all the blowdown and the other none. It is preferable to have a slow-opening valve on each branch from the boiler and a quick-opening valve on the main line. When all valves are closed and you



desire to blow down the boiler, open the quick-opening valve first, then the slow-opening one so as not to put too great a shock on the boiler. In sketch 1-A proceed as follows: First open quick-opening valve No. 1, then valve No. 2. After blowing down the desired amount, close No. 2. Open No. 3 and close it after the desired amount of blowdown. Then close No. 1. Thus everything is secure.

New York, N. Y. GEORGE GRIFFEL

Blowdown Valve Operation

REASON for opening a quick-opening valve first and closing it last is to maintain a tight seal and avoid violent shocks that are produced when opening it suddenly against pressure differential. On a 2-in. valve, there is $2 \times 2 \times .7854 \times 150$ psi $= 471$ lb of force acting against the disk.

Oaklyn, N. J. C A WILKES

Purpose of Blowdown

ESSENTIAL REQUIREMENTS of any blowdown system are:

1. Valves must be slow operating to avoid applying large stresses to boiler parts by suddenly starting or stopping water flow. Because safe operation is the first fundamental, a cock or second valve should be installed to protect against leakage.

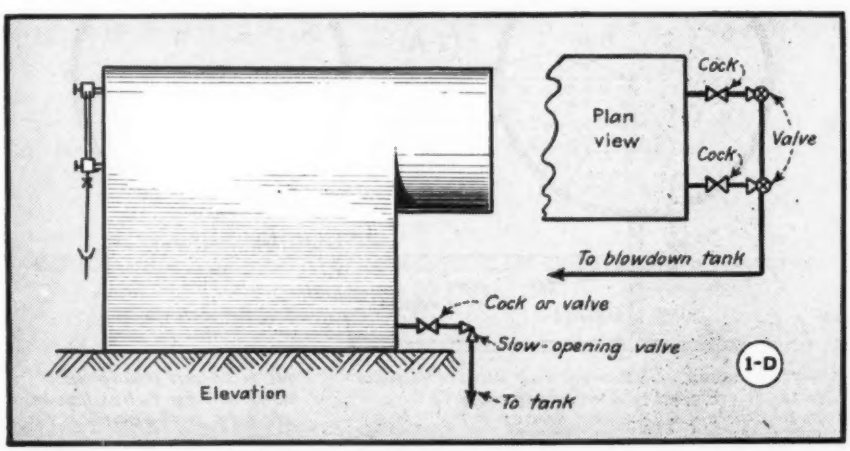
2. Arrange system so that removal of sludge, solids and water from each section is under definite control of the operator. Parallel branches should not be used as all or a large part of flow may be from one branch only. Blow only one line at a time unless the boiler is being emptied.

3. Blowdown valves should be heavily built, with renewable wearing parts, without pockets to collect solids, and with passages unobstructed by baffles or seat arrangement. Valves should close tightly, yet operate easily without sticking. Seats should be so designed that they are wiped free of solids in closing. Quick-opening valves or cocks have some advantages for tight closing with dirty water, take less space, and are normally less expensive, but cannot be used alone or to control flow.

4. Blowdown piping should be well supported and exposed for easy inspection. Locate the valves for convenient operation or fit them with extension handles.

5. Have the blowdown outlet visible if possible for easy checking of leakage; blowdown-tank vent should be open and visible.

Sketch 1-D shows the system recommended for BW's boiler. Before making any alterations obtain complete State laws and insurance regulations. Exact regulations under the ASME Code depend on boiler pressure and whether the boiler is new or part of an old installation. Existing installations which require alterations are treated as new and must conform with paragraphs P-307 to P-313 of the ASME Code if it applies. For new installations with multiple branches a master



valve can be used if each branch has a separate valve; or two valves (or one valve and one cock) can be fitted to each branch. Slow-opening valve controlling flow must always be opened last and closed first. Detailed operating instructions are given in Section 7 of the Code "Suggested Rules for Care of Power Boilers."

Saint John, N. B. C G CLARK

Requires Three Valves

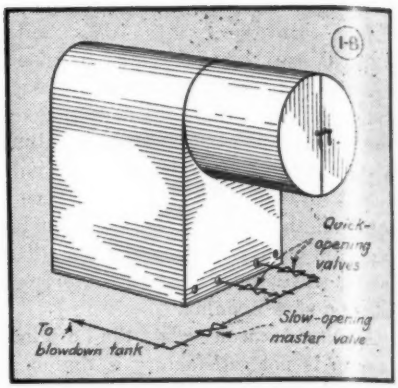
BLOW-OFF VALVES on BW's boiler are arranged incorrectly according to ASME requirements. To quote ASME Code for Power Boilers, Paragraph P-311 (a):

"On all boilers, except those used for traction and/or portable purposes, when the allowable working pressure exceeds 100 psi, each bottom blowoff pipe shall have two slow-opening valves, or one slow-opening and a quick-opening valve.

"On a boiler having multiple blowoff pipes, a single master valve may be placed on the common blowoff pipe, in which case only one valve on each individual blowoff is required. Either the master valve or the individual valves must be of the slow-opening type."

This clearly states that a minimum of three valves are required on BW's boiler; one on each individual blowoff and a master valve after the tee, sketch 1-B. I would use a quick-opening valve on the branches and a slow-opening one as the master valve, but all three could be slow-opening.

Philadelphia, Pa. J S HAMILTON



Use Extra-Heavy Fittings

ASSUMING BOILER OPERATES under code regulations, two valves are not usually required on each blowdown pipe unless maximum allowable working pressure

(*Continued on page* 178)

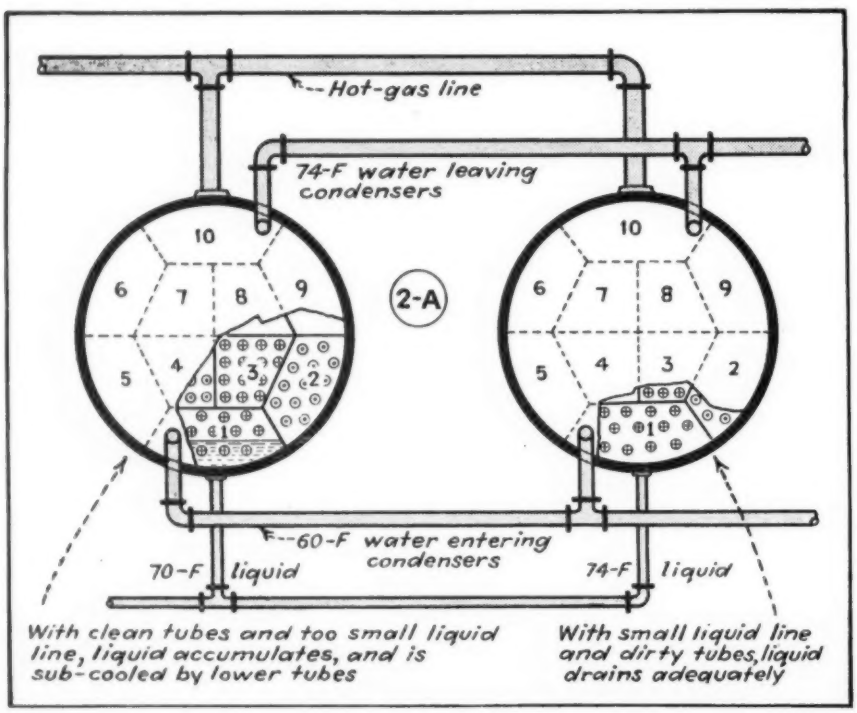
What Causes Ammonia Temperature to Vary?

(This is Question 2 from the August issue, with best answers from readers.)

We have an ammonia refrigerating system for ice making and process cooling. The two shell-and-tube condensers mount above the receivers. Water at 60 F enters the bottom, makes ten passes through each condenser and leaves at the top. Discharge water averages 74 F.

Ordinarily liquid ammonia leaves the condensers at the same temperature as discharge water, 74 F, except several days after each cleaning. During this period liquid ammonia temperature averages 4 F lower than discharge water. Head pressure variation is small.

Condenser tubes seldom show more than a thin coating of slime even after an extended run. Is it just a coincidence that the ammonia temperature fluctuates in this manner, or is something wrong with the water circulation? Would an additional pump to increase the velocity of the water correct the trouble we are experiencing?—BHT


Hot-gas line
74-F water leaving condensers
2-A
60-F water entering condensers
70-F liquid
74-F liquid
With clean tubes and too small liquid line, liquid accumulates, and is sub-cooled by lower tubes
With small liquid line and dirty tubes, liquid drains adequately

Clean Condensers Oftener

SUBCOOLING THE LIQUID AMMONIA leaving condensers can hardly be classified as trouble. Such subcooling improves economy, especially if the liquid can be maintained at this lower temperature until it reaches the expansion valves.

In BHT's case, subcooling seems to be caused by too small liquid lines between condensers and receiver, coupled with increased condenser capacity for a time after cleaning. Liquid lines may be large enough to keep condensers drained when dirty tubes retard condensation. But with clean tubes liquid accumulates in the condensers faster than the lines can drain them. As shown in sketch 2-A, this liquid contacts the tubes of the first pass, and is subcooled by the 60-F water just entering. Clean the condensers more often.

Marissa, Ill. GEORGE HOLMAN

Suggests Condenser Test

IT'S NOT JUST COINCIDENCE that the ammonia temperature fluctuates but is to be expected as the result of changing condenser conditions. Ammonia temperature will be lower after condenser tubes are cleaned since more efficient heat exchange takes place.

An additional pump would result in a lower ammonia temperature but before installing one I suggest that BHT conduct a test to estimate just what improvement could be obtained. Keep the amount of ammonia substantially constant and operate the condenser long

enough (at least one hour) at each test point to obtain a true reading.

First operate with maximum water flow through the condenser and note pressure and temperature of the entering water, temperature of water and ammonia leaving the condenser and rate of water flow. The latter can be determined by collecting the discharge for 30 sec or a minute and measuring accurately the time elapsed and the amount of water collected. Then partially shut off the water and, after waiting until conditions become stable, take the same measurements again. Repeat this test at four or five different operating points and plot a curve—ammonia temperature versus cooling-water flow. Extend the curve by approximation beyond the present operating point to indicate decrease in ammonia temperature for any increase in cooling water.

As the cooling water flow is increased temperature of ammonia leaving the condenser decreases, approaching that of the entering water. After a certain temperature is reached it requires a comparatively great increase in rate of cooling-water flow to produce even a small decrease in ammonia temperature.

This test procedure is based on the assumption that water flows through the condenser opposite to that of the ammonia. BHT does not definitely state this but says that the condenser is mounted on top of the receiver which indicates that ammonia flows downward.

Elmira, N. Y. M H ELKIN

Check Pump Operation

FROM THE EXPLANATION nothing seems wrong with either condenser or water pump. Any sort of film on the water-tubes necessarily affects condenser's heat transmission.

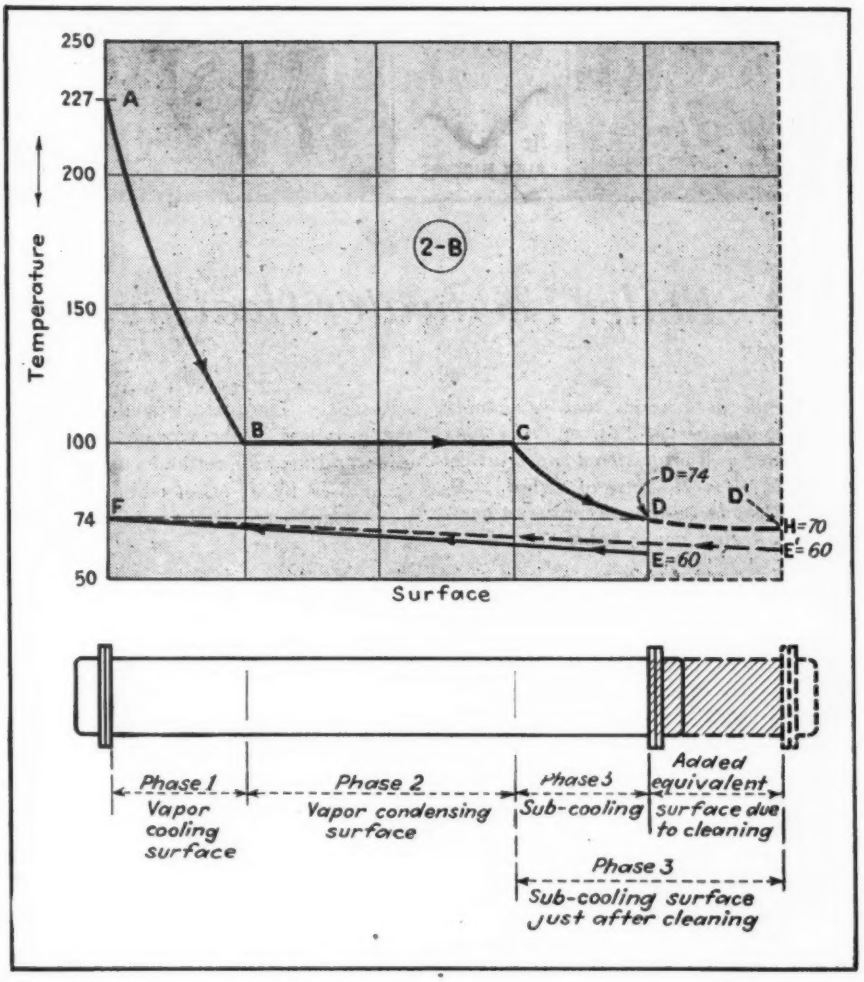
A larger pump will probably lower the liquid-ammonia temperature and head pressure. However, BHT will have to balance out additional cost of current and water.

Best solution is to clean the condenser at fairly regular intervals and check the water pump as a routine matter.

Brooklyn, N. Y. *A J Wenig*

Condensation Occurs In Three Stages

SINCE HEAD-PRESSURE VARIATION is small we can assume certain head and suction pressures. With a head pressure of 195 psi and a suction pressure of 25-psi gage, discharge temperature from saturated ammonia tables is 227 F. This temperature exists at the beginning of condensation.



Condensation occurs in three phases:

1. *Vapor-cooling stage.* Ammonia vapor must be cooled to a temperature at which it begins to condense. This phase requires a certain amount of surface and a quantity of cooling water that is heated up a number of degrees.

2. *Vapor-condensing phase.* At this temperature condensation begins: for each pound of vapor condensed a certain amount of heat leaves the vapor and is absorbed by the water, which rises in temperature. This rise depends upon the quantity and temperature of water flowing in this section. The temperature of condensation for ammonia from saturated gas tables at a pressure of 195-psi gage is about 100 F. Temperature remains constant until all vapor is condensed.

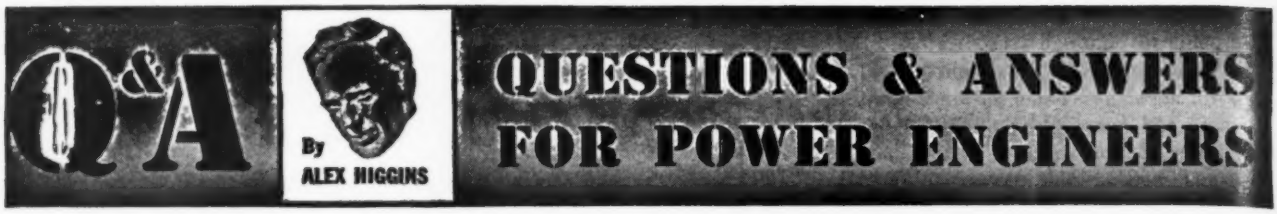
3. *Liquid subcooling phase.* When this pound of ammonia has condensed, cooling of the liquid below 100 F takes place. Again a certain quantity of water is raised a certain number of degrees. This also requires a certain amount of active heat-transfer surface.

Every condenser does a certain amount of liquid subcooling because there can be no sharp line of demarcation between condensing and subcooling surface. Turbulence and other intangibles play a great part in heat transfer. Amount of subcooling depends upon the surface in excess of that required for condensing alone.

In sketch 2-B point *A* to *B* shows vapor cooling; point *B* to *C*, condensing; point *C* to *D*, liquid subcooling. Water entering *E* at 60 F leaves point *F* at 74 F. These conditions prevail under ordinary operating conditions when the tubes are slightly slimed. For the 14 F rise (74-60) the quantity of water circulated is commensurate with good practice. Each phase requires a certain amount of condensing surface and the total makes up the two condensers.

When the condensers are cleaned, heat transfer rate increases. As a result more subcooling takes place. This is equivalent to adding more surface with the tubes slimed. The subcooling curve flattens out and drops

(*Continued on page* 182)



19—*Boiler Feedwater Heating and Treatment (Part I)*

Nineteenth in a series that is running in every number of* POWER. *From long experience as a professional and practical engineer, Alex Higgins, of Calgary, Alberta, Canada, asks and answers questions regarding power equipment.

Q 1—What are the effects of impure feedwater in boilers?

A—Effects are: (1) foaming and priming (2) mud deposits on heating surfaces with consequent danger of burning or bagging plates (3) scale deposits on heating surfaces, retarding transmission of heat through metal, with wastage of heat and danger of plates overheating and burning or bagging. (4) corrosion of plates and other metal surfaces.

Q 2—What are the common impurities in boiler feedwater?

A—Impurities in boiler feedwater may be divided into:

(1) *Scale-forming substances:* The principal ones are the carbonates and sulphates of lime and magnesium.

(2) *Scum-forming substances* (may be mineral or organic): (a) Mineral scum-forming or foaming impurities usually contain soda in the form of a carbonate, chloride or sulphate. (b) Organic impurities that form scum or foaming are usually found in water containing sewage.

(3) *Sludge-forming substances,* usually solid mineral or organic particles, carried in suspension.

(4) *Corrosive substances* may be chemical compounds, namely chloride of magnesium, free acids, or gases such as oxygen and carbon dioxide.

Q 3—What are the chemical impurities commonly found in boiler feedwaters?

A—Principal impurities, with their technical names, chemical symbols, common names and effects, are given in the table to the right.

Q 4—What is meant by "hard" and "soft" water?

A—Hard water contains an excess of scale-forming impurities, while soft water contains little or no scale-forming substances. Hardness is mainly due to the presence of the carbonates of calcium and magnesium and can easily be recognized by its effect on soap. Much more soap is required to make a lather with hard water.

Q 5—How is hardness expressed?

A—In U. S. practice, it is expressed either in parts of calcium carbonate per million parts of water (ppm) or in grains of calcium carbonate per gal.

Q 6—What is the relation between ppm and grains per gallon?

A—1 ppm=0.058 grains per U. S. gal
1 grain per U. S. gal=17.1 ppm

Q 7—What are the principal scale-forming impurities in boiler feedwater, and what kinds of scale does each deposit?

A—Principal scale-forming impurities are the sulphates and chlorides of lime and magnesium, which form a hard scale, and the carbonates of lime and magnesium, which form a soft scale. Silica also forms a dense, hard scale and has a hardening influence on the soft scale-forming substances.

Q 8—Explain what is meant by temporary and permanent hardness and the treatment necessary to reduce each.

A—Water containing only the carbonates of lime and magnesium is said to have *temporary* or *carbonate* hardness because these impurities can be caused to precipitate as a soft sludge if water is heated to temperature close to boiling point at atmospheric pressure.

Water containing the sulphates of lime and magnesium is said to have *permanent* or *noncarbonate* hardness because these impurities do not precipitate as solids until the water is heated to a temperature over 300 F. Thus, where water passes directly through an open heater to the boiler, heater temperature is not high enough to precipitate the permanent hardness. It therefore deposits in the boiler.

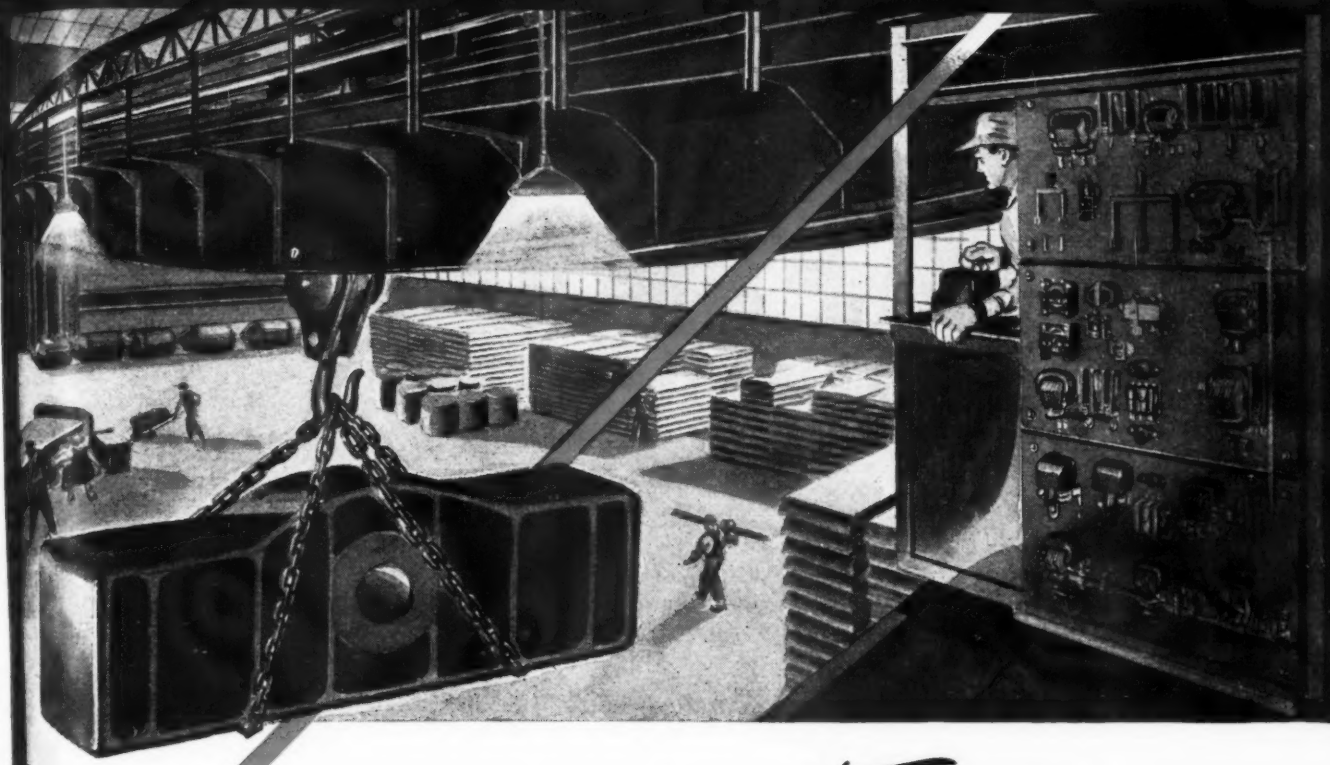
Q 9—What methods are commonly used to purify feedwater or neutralize the bad effects of impure feedwater?

A—There are three general methods of treatment: (1) mechanical, using filters and settling tanks (2) chemical, using chemical treatment before or after feeding the water into the boiler (3) thermal, using feedwater heaters.

(*Continued on page* 116)

Common Chemical Impurities in Boiler Feedwaters

Name	Symbol	Common Name	Effect
Calcium carbonate	$CaCO_3$	Chalk, limestone	Soft scale
Calcium bicarbonate	$Ca(HCO_3)_2$	.....	Soft scale
Calcium sulphate	$CaSO_4$	Gypsum, plaster of Paris	Hard scale
Magnesium carbonate	$MgCO_3$	Magnesite	Soft scale
Magnesium sulphate	$MgSO_4$	Epsom salts	Corrosion
Silicon dioxide	SiO_2	Silica	Hard scale
Calcium chloride	$CaCl_2$	.....	Corrosion
Magnesium bicarbonate	$Mg(HCO_3)_2$	.....	Scale, corrosion
Magnesium chloride	$MgCl_2$	.....	Corrosion
Sodium chloride	NaCl	Common salt	Electrolysis
Sodium carbonate	Na_2CO_3	Washing soda or soda ash	Alkalinity
Sodium bicarbonate	$NaHCO_3$	Baking soda	Priming, foaming
Sodium hydroxide	NaOH	Caustic soda	Alkalinity embrittlement
Sodium sulphate	Na_2SO_4	Glauber's salts	Alkalinity



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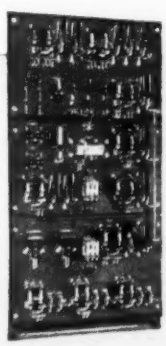


Engineering Excellence finds its Greatest Reward in the Respect and Confidence of those it Serves

Q&A FOR POWER ENGINEERS

(*Continued from page* 114)

Q 10—What are the mechanical methods of feedwater treatment?

A—Water containing solid matter in suspension may be purified by (1) chemical means alone (2) settling tanks or filters or (3) both. Settling tanks are large tanks into which the feedwater is pumped or run by gravity and allowed to stand for a time before being pumped into the boiler. This permits most of the suspended solids to settle to the bottom of the tank whence they are washed out through a drain at intervals.

Filters are tanks containing charcoal, coke, excelsior or other finely divided filling through which the feedwater passes before it reaches the boiler feed pumps.

Q 11—What are the chemical methods of treating boiler feedwater?

A—There are two general methods: (1) Water is pretreated in a suitable purifying apparatus by adding chemicals to neutralize any acids present and precipitate the scale-forming impurities. The water is then filtered to remove these solids before it passes into the boiler. (2) Chemicals are simply added to the water as it is pumped into the boiler, or they are introduced separately into the boiler. Thus the solids precipitate and accumulate in the boiler itself.

Outside treatment is generally much better. With internal treatment, though the impurities are neutralized and rendered nonscaling and noncorrosive, there is a heavy concentration of chemicals and possibly solids in the boiler itself.

Q 12—What should be done before adopting any form of chemical treatment for boiler feedwater?

A—Before starting to use any treatment, send samples of the feedwater to a competent analyst, who will report on the nature of the impurities and recommend the proper chemical treatment. Follow his advice.

Q 13—What is coagulation?

A—This is partly a mechanical and partly a chemical process of water purification used in connection with filtering. Much of the impurity in surface waters is in a finely divided state and takes a long time to settle, or it may even be fine enough to pass through voids in the filtering material. By adding certain chemicals to the water, gelatinous or jellied substances are formed which cause the small particles of mud and silt to coalesce into groups too large to pass through the filtering material.

Q 14—What are boiler compounds?

A—They are commercial preparations in powdered, solid or liquid form, made to treat impure boiler feedwater. Carbonate of soda, caustic soda, phosphate of soda and tannin are common ingredients of boiler compounds. It is possible, though unlikely, that a compound may prove quite beneficial even if no tests have been made to determine its suitability, but the blind buying of a chemical compound guaranteed to cure all boiler ills is a mistake. No single mixture of chemicals can possibly be effective in neutralizing the impurities in all feedwaters.

If you use a boiler compound, buy it from a reputable company that makes a specialty of analyzing feedwater and making up a compound to suit each case, or submit samples of the feedwater and the proposed compound to a qualified analyst, for test and advice on the compound's suitability for treating the feedwater. Further tests should be carried out at fairly close intervals as the nature of the impurities in the feedwater may vary greatly from time to time.

Q 15—What are the commonest chemicals used in feedwater treatment?

A—Slaked lime, $Ca(OH)_2$, and soda ash, $NaCO_3$, are the commonest. Slaked lime reduces temporary or carbonate hardness caused by the carbonates of lime and magnesium. Soda ash reduces permanent or noncarbonate hardness caused by the sulphates of lime and magnesium.

Q 16—Describe the lime-soda treatment for boiler feedwater.

A—In this process lime is added to the water to reduce the carbonate hardness. The carbonates of calcium and magnesium, which are the main impurities producing temporary hardness, are usually combined with dissolved CO_2 (carbonic acid), forming bicarbonates, which are soluble in water. The lime combines with the carbonic acid, so the bicarbonates are then reduced to calcium carbonate and magnesium hydroxide, which are insoluble and precipitate as a sludge.

Noncarbonate, or permanent, hardness resulting from the sulphates of lime and magnesium, is reduced by adding soda ash. This decomposes the soluble sulphates into carbonates, which precipitate as solids, and soluble salts, which do not form scale in the boiler.

The water can be treated cold, but the chemical reactions are much quicker if it is heated almost to the boiling point. Use settling tanks and filters to remove the sediment.

Most feedwater treatments do not produce "pure" water. They may really increase the impurities, as chemicals are added in most cases, but the original objectionable impurities are now changed to a less harmful form.

Q 17—Sketch and describe a hot-process water-treating plant.

A—A hot-process feedwater-treating plant is shown in Fig. 1. Raw water enters the top of an open heater where its temperature is raised by direct contact with exhaust steam. This heating eliminates some of the dissolved gases car-

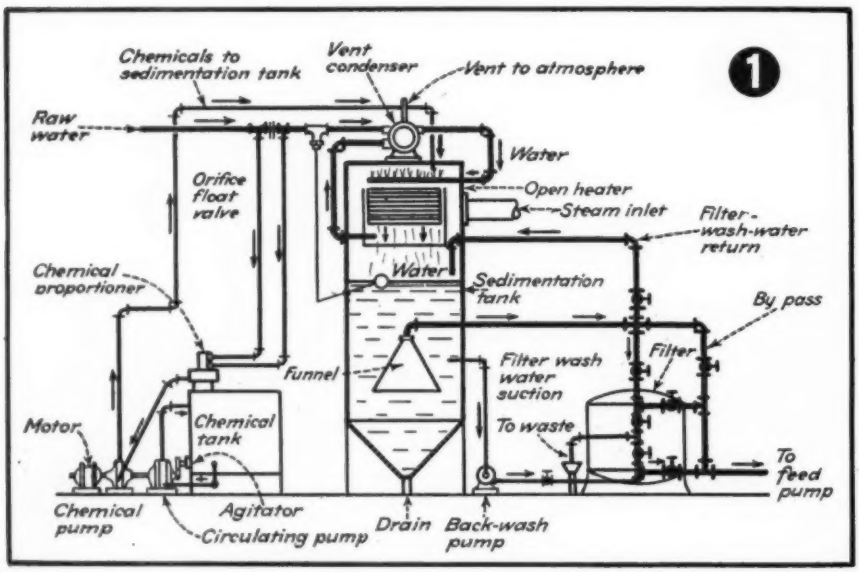


Fig. 1—The hot-process softener uses high temperature to speed up chemical reactions. Among the treating chemicals commonly used are lime and soda ash

Yarway Impulse Traps

For Pressures Up to 1500 lbs

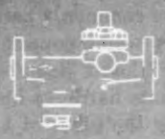


Fig. No. 140 to 147. Medium pressure integral-strainer Impulse Trap for pressures up to 600 lb. Steel body, flanged connections.

Fig. No. 150 to 157. Super-pressure integral-strainer Impulse Trap for pressures up to 1500 lb. Steel body, flanged connections.

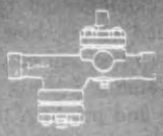


Fig. No. 250 to 257. Medium pressure integral-strainer Impulse Trap for pressures up to 600 lb. Steel body, socket weld connections.

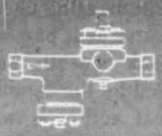
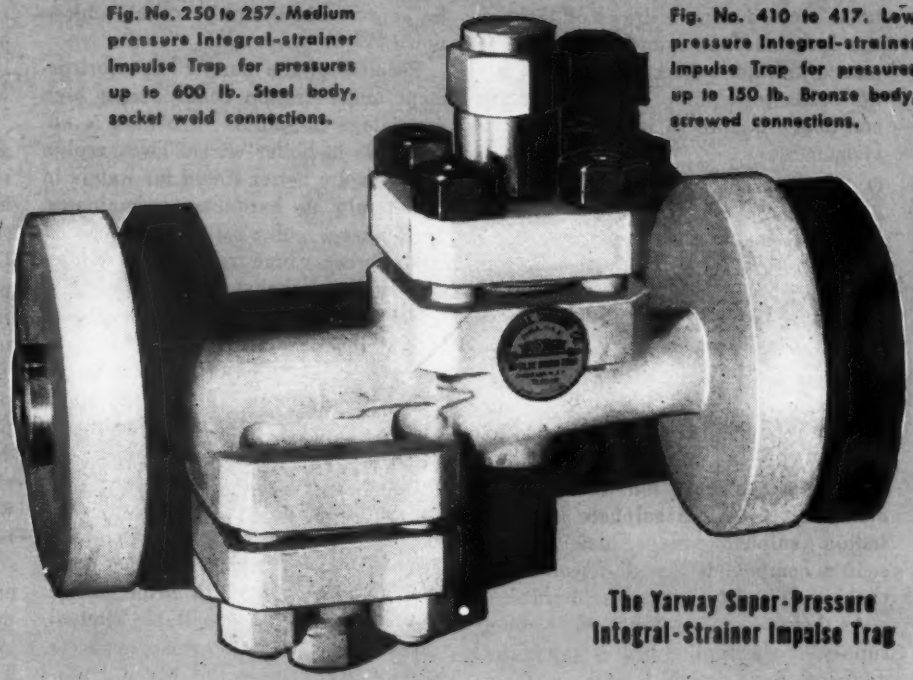
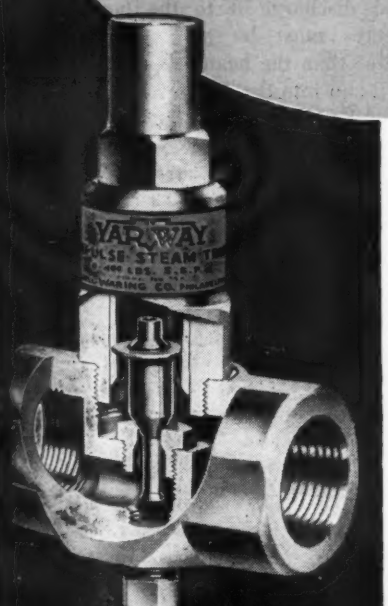


Fig. No. 410 to 417. Low pressure integral-strainer Impulse Trap for pressures up to 150 lb. Bronze body, screwed connections.



The Yarway Super-Pressure Integral-Strainer Impulse Trap



The Standard Yarway Impulse Trap. Note only one moving part — a little valve.

ALONG with the remarkable success of the YARWAY IMPULSE TRAP for standard trapping service (more than 250,000 have been purchased), has come its use in steam plants where pressures as high as 1500 lbs and temperatures as great as 900°F are encountered.

The integral-strainer trap shown above, developed for this service is suitable for every drainage requirement in high pressure steam installations. It has ample condensate capacity when system is being "warmed up". It will handle relatively small amounts of high temperature condensate, efficiently, without losing its prime.

The valve closes positively in the presence of dry or superheated steam.

It is a fraction of the size and weight of other type traps designed for the same service—saving space, simplifying installation and requiring no support.

It is suitable for all pressures within a wide range without change of valve or seat.

It has the same simplicity of design as does the standard Impulse Trap—only one moving part, a little valve.

Its integral-strainer protects the trap against scale and rust in the system.

For complete description of operating principle, send for Bulletin T-1738.

YARNALL-WARING COMPANY, 100 MERMAID AVE., PHILADELPHIA 18, PA.

YARWAY IMPULSE STEAM TRAP

Q&A FOR POWER ENGINEERS

(*Continued from page* 116)

ried by the water and vents them to the atmosphere through the vent condenser. The treating chemicals are added to the water as it passes into the sedimentation tank beneath, and the sediment deposited by the combined heating and chemical action is washed out at intervals through a drain in the bottom of the tank. Treated water is drawn off through the inverted funnel and, if necessary, passed through a filter before it reaches the boiler feed pump. The water takes one hour or more to pass through the system.

Q 18—Describe the zeolite process of softening water.

A—This process uses a sandlike substance called zeolite (natural or artificial) arranged in a filter bed. This substance has the remarkable property of *base exchange*. When hard water passes through a bed of zeolite the calcium and magnesium in the hardness compounds pass *into* the zeolite and are replaced by sodium *from* the zeolite. Thus calcium bicarbonate becomes sodium bicarbonate, and magnesium sulphate becomes sodium sulphate. Since none of the sodium compounds is scale forming this exchange frees the water from hardness.

As this process continues, the sodium supply of the zeolite bed is gradually depleted until it no longer properly softens the water. The zeolite is then restored to its original condition by the action of a strong brine of common salt. This puts sodium back into the zeolite and removes calcium and magnesium.

Zeolite-treated waters show *zero hardness* by the soap test, but are, of course, laden with soluble sodium salts. To avoid foaming and priming, the concentration of these salts in the boiler must be kept within limits by suitable blowdown.

Because of the danger of embrittlement under certain conditions, a high percentage of sodium carbonate is undesirable in boiler water. Thus, zeolite softeners are better suited for waters in which sulphate hardness predominates. Sometimes a zeolite softener is preceded by hot-process lime treatment to remove most of the carbonate hardness.

Fig. 2 shows a modern zeolite softener with automatic control. During the softening part of the cycle, water flows downward through the zeolite bed. When the water softening capacity of the zeolite approaches exhaustion the automatic valves cut off the downward flow and backwash upward to loosen the material and remove deposited dirt. Third step is admission of a measured quantity of common salt brine at the top of the bed. After a suitable interval a stream of rinsing water removes excess salt and cleans the zeolite, which is now ready for another softening cycle.

The unit pictured makes the various

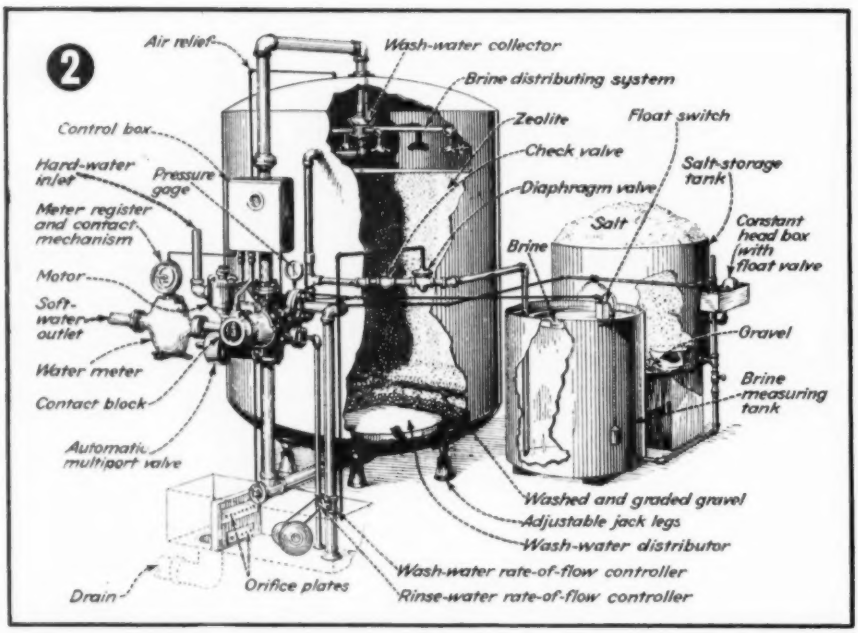


Fig. 2—In the zeolite softener the bed of sandlike zeolite is not dissolved, but it does require periodic regeneration with brine to restore the sodium

valve changes automatically at the right time, as determined by the water meters.

Q 19—What are the thermal (heating) methods of feedwater treatment?

A—In thermal purification the water is heated before it enters the boiler to a temperature where the chemical impurities in solution will solidify and deposit in the heater. Feedwater heaters are two main types: *open* and *closed*. Open heaters are commonly used both to heat and purify water containing carbonate hardness. Closed heaters, too, reduce noncarbonate hardness but the difficulty of cleaning the tubes of a closed heater is a strong objection to its use as a water purifier.

The open heater is generally (but not always) open to the atmosphere. The essential feature of an open heater is that it contains no heat-transfer surfaces, the steam and water being in direct contact. Usually open heaters operate at atmospheric pressure, or very slightly higher. Hence it is impossible to raise temperature of the water in the heater much above boiling point at atmospheric pressure (212 F at sea level). In practice, the temperature is often kept a few degrees below the boiling point because of the difficulty of pumping very hot water. The boiler feed pumps are placed between the open heater and the boiler so that they draw water from the heater and discharge it to the boilers. The pumps must be placed considerably lower than the heater so that the water will run into the pump suction by gravity. Water close to 212 F cannot be raised by pump suction. Open heaters are generally placed on a high platform in the boiler room.

A closed feedwater heater is simply a steel shell containing rows of tubes. Live or exhaust steam enters this shell and passes around the tubes (ordinarily). The feedwater circulates through the tubes and is warmed by the heat conducted through the walls of the tubes from the steam. As the closed heater is usually placed between the feed pump and the boiler, the water in the heater is always under boiler pressure, or higher, and so its temperature can be raised much higher than that of the water in an open heater.

Q 20—How is water purified in an open heater?

A—Heating water almost to the boiling point causes the carbonates of lime and magnesium to solidify and deposit in the heater. These are the impurities that cause temporary, or carbonate, hardness. Water containing these impurities would deposit a soft porous scale in the boiler. Gases such as oxy-

(*Continued on page* 136)

PISTON RINGS GET A *Good* "BREAK"

SOLNUS OILS

End Hard Carbon and Stuck Rings . . . Reduce Repairs

Broken piston rings were a common occurrence in a municipal power plant equipped with 300 H.P. 4-cylinder, 210 H.P. 3-cylinder and 120 H.P. 2-cylinder Fairbanks-Morse diesel engines. The rings had to be broken to be freed every time the engines were cleaned . . . until one day they got a good "break." Here's how it happened.

Shutdowns 2 or 3 times a year for cleaning were necessary with the lubricating oil they were using. These shutdowns always disclosed the top rings stuck with hard carbon deposits — so badly stuck they were often broken while being removed. Production delays were too frequent . . . maintenance costs excessive. A Sun Oil Engineer suggested that the trouble was incorrect lubrication, and recommended low-carbon Solnus Oils.

Now only once a year they shut down the engines for cleaning . . . and then never find any hard carbon, never any stuck rings. They are always free and easily removed. Power interruptions have been reduced . . . maintenance time, labor and money saved.

Save and Serve with Solnus Oils. These oils that are low in carbon content, durable, wholly distilled, and neutral in acidity can provide lubrication for your diesels that will save you time . . . equipment . . . labor, too. Sun has a complete "Save and Serve" Plan including free lubrication booklets, charts, posters, bulletins, etc., which is yours without cost or obligation. . . . Write for descriptive folder.

SUN OIL COMPANY • Philadelphia 3, Pa.

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SUN INDUSTRIAL PRODUCTS

HELPING INDUSTRY HELP AMERICA

REFRIGERATION NOTEBOOK — 16

High Vacuum and Deep Freezing Dry Penicillin

By TERRY MITCHELL, ME, *Frick Company*

SELDOM HAS any new use of refrigeration become so important so quickly as the one now being applied to the making of penicillin.

This drug must be moisture free or it won't keep. Sufficient heat to drive off the water cannot be used as this would kill the life in the penicillin. (The finished product is sealed and has to be stored at 50 F.)

The problem of removing the tremendous amount of water vapor at low temperature was solved in a novel manner by the National Research Corp, a Boston concern specializing in high vacuum operations. They designed, built and installed equipment that combines low temperatures (down to 75 F below zero) with the highest vacuum ever applied to commercial dehydration work (1/100th of one millimeter of mercury or less).

The first full-sized plant making penicillin by vacuum diffusion process was built by the Commercial Solvents Corp, at Terre Haute, Ind., in just 160 working days; cost, $1,750,000. Several plants using similar equipment are in use elsewhere in this country, and four of them are being supplied to our ally, Russia, for drying blood plasma.

Concentration of extract from the vegetable mold is a story in itself, but after the penicillin is placed in bottles, each holding 100,000 units, it is first deep frozen. The bottles are then put on shelves in drying chambers, called "ovens." Pipes above the battery of ovens lead to vacuum pumps, which are in two stages. Evaporation of the ice occurs without any melting: In fact, the moisture "sublimes" with a refrigerating effect, and to hasten the process a low heat has to be added through hot water headers leading to the shelves.

Moisture Freezer

A sloping shell in the vacuum line serves as a moisture freezer or condenser. It is jacketed with very cold ammonia from a booster system, and equipped with revolving blades for scraping off the condensed vapor that forms inside, as the low temperature and high vacuum are applied. The ice falls into an air-tight vessel below; this is heavily insulated and is refrigerated, through a jacket, to keep the moisture from re-sublimating. A small area in the slanted shell suffices to handle a large cooling load: Under the intense vacuum, molecules of moisture race toward the cold surface with terrific speed. Frost deposits on the surface as fast as the blades of the scraper can sweep it into the chamber below.

This drying process was originally developed as a means of dehydrating foods without "cooking" them or destroying their flavor or vitamins. Thus color, even the form, of the food is retained. Moisture content is reduced to less than 1%, whereas the usual air-drying methods leave about 5 to 10%. By adding cold water the food may be restored to its initial freshness in a few seconds, the moisture entering through the minute holes in the cells through which it had passed when sublimated.

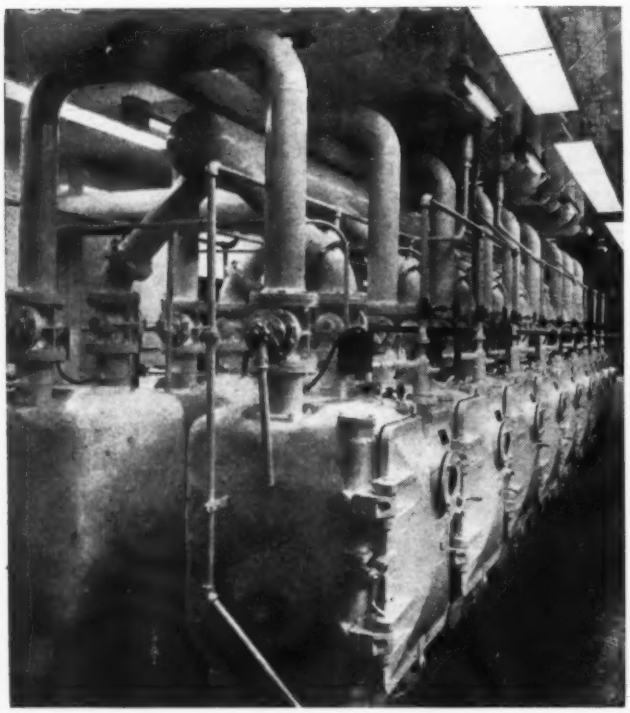


Fig. 1—Battery of high-vacuum dehydrators for penicillin at Commercial Solvents Corporation, Terre Haute, Ind.

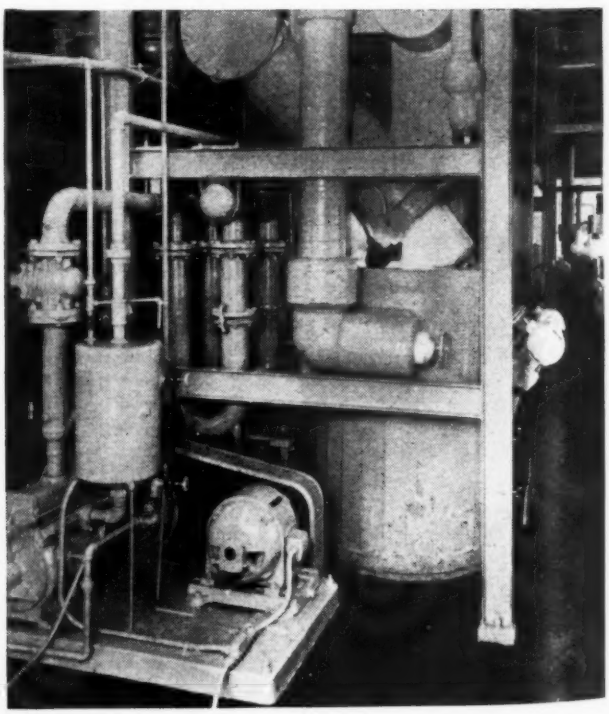
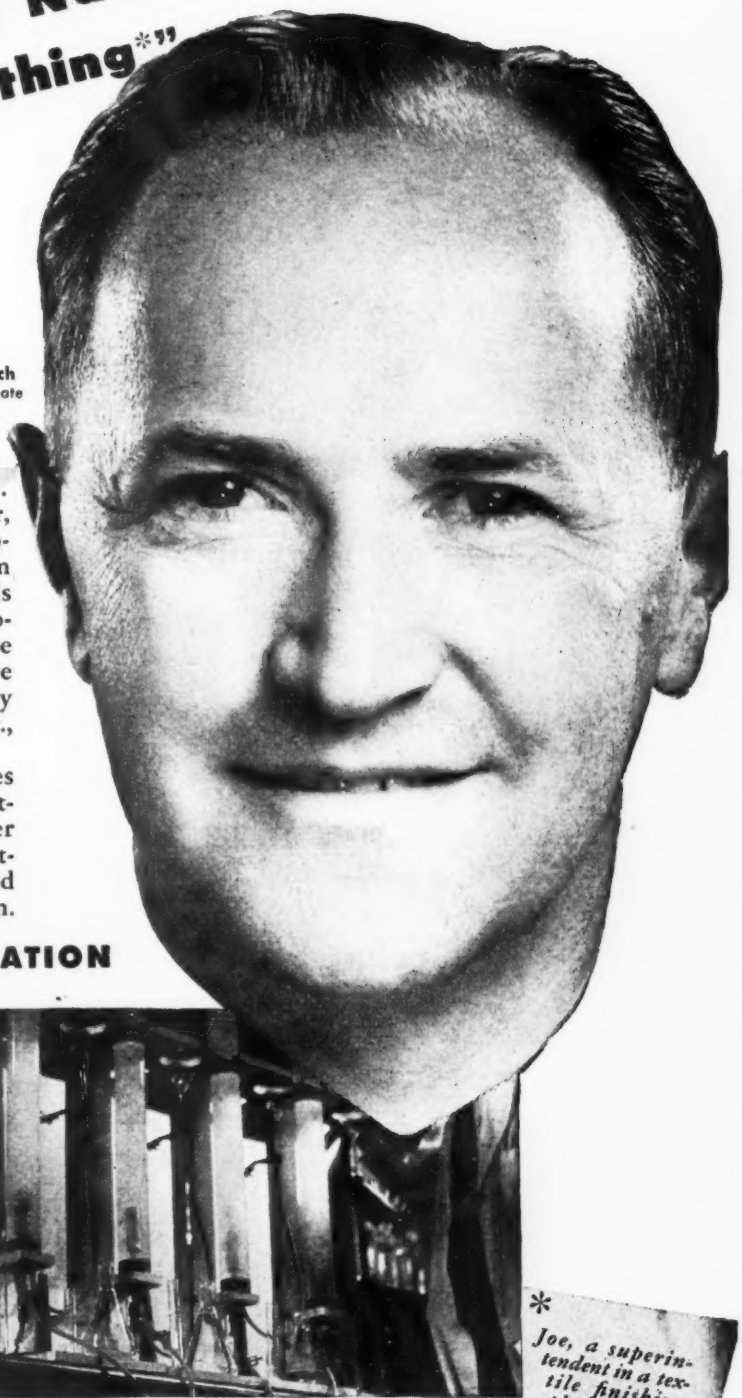


Fig. 2—Vacuum unit with high-vacuum diffusion pumps, low-temperature condenser and booster compressor

"But Joe . . .

we never said Nalco was good for everything*"



J. H. Gronbach
National Aluminate Corporation

WE are right with you on that subject, Joe . . . we would not have anything in our plant either, *that does everything!* We have dug into the subject of boiler feed water treatment too far to claim that there is any one-shot, cure for *all* the ills caused by untreated water. But our modern laboratories have discovered and established definite facts regarding water treatment . . . facts that are enabling power plant engineers to successfully prevent scale, corrosion, foaming, algae, etc., under a wide range of conditions.

Nalco's modern water treatment laboratories have revolutionized certain phases of water treatment to bring to Nalco customers fewer boiler outages, more boiler capacity and lower operating costs. Ask for a Nalco survey today Joe, and you will see what we mean. There's no obligation.

NATIONAL ALUMINATE CORPORATION
6222 West 66th Place • Chicago 38, Illinois

Canadian inquiries should be addressed to Aluminate Chemicals, Ltd., 555 Eastern Ave., Toronto, Ont.

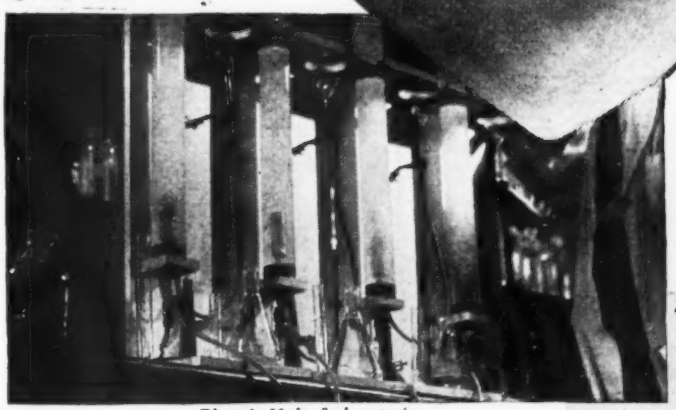


Photo in Nalco Laboratories

* *Joe, a superintendent in a textile finishing plant says—"I wouldn't waste my time on water treatment that does everything."* Source: Survey conducted by a well-known power publication.

Nalco . . . The Complete Water Treating Service

HOW TO FIT AND TEST THE CANISTER MASK*

Canister gas masks are available that protect a man against any poisonous industrial gas whether occurring singly or in combinations. But concentrations must not be over 2% (3% for ammonia) and sufficient oxygen must be present to support life.

For instance: Never use a mask for protection in a confined space, such as a storage tank or sewer. These areas may lack oxygen through dilution, absorption or oxidation of material stored therein. Before using a canister mask be sure that it is designed for protection against the gas present.

Noticeable odors inside the facepiece indicate one of these four conditions: gas concentration that is excessive, an exhausted canister, facepiece that is not sealing against the face, or a leak in the mask.

If breathing through the mask should become difficult, the canister may have broken down, and you should therefore leave the gaseous area at once.

Photographs, courtesy of the Mine Safety Appliance Company

1 **Put mask on in fresh air so that there is no odor of contaminating gas inside the facepiece. Place carrying strap around the neck and *fasten* waist band. This keeps the canister close to the body when stooping over.**

2 **Lift facepiece by holding the two straps on each side between thumb and index finger of each hand. Make sure that the flexible tube is not kinked. Throw the junction of the straps outward and thrust the chin into the facepiece. Then pull junction well back over the head.**

3 **Adjust the neck strap tight on each side at the same time; then the side strap on each side. Grasping the facepiece at the chin with one hand, and the junction of the straps with the other hand, move the mask to a position that is comfortable. Then readjust the straps.**

4 **Test the mask for tightness by holding the heel of one hand over the bottom canister opening, from which the seal previously has been removed, take a deep breath and hold for a few seconds. If mask is gas tight, the facepiece will collapse against the face.**

The ability of a gas-mask wearer to perform work is less than when breathing free. Unless the emergency requires it, do not put a mask on while breathing heavily.

*For additional information on this type of mask see, "Fit the Industrial Mask to the Job," Power, September, page 103.

Preview of Dependability

American Flexible Metal Hose Proves Its Fitness Before Leaving The Factory

BUY WAR BONDS
Buy More Than Before

EVERY LENGTH of American Flexible Metal Hose, before leaving the factory, is thoroughly tested under pressure as a final check. This operation is typical of the care exercised in the manufacture of AMERICAN products, and is one of the reasons why AMERICAN maintains such an enviable reputation for dependability.

Wherever a practically indestructible, flexible, airtight conveyor is required for oil, gas or liquids; for vacuum service or for isolating vibration, it is logical to turn to American Flexible Metal Hose.

American Flexible Metal Hose withstands heat and high pressures without deterioration. It is resistant to many of the corrosive influences which render non-metallic hose impractical to use. Furnished in bronze and other workable metals with or without couplings, there is a type for nearly every industrial purpose.

The Technical Department of The American Metal Hose Branch of The American Brass Company is prepared to offer suggestions and make recommendations regarding special applications.

ANACONDA

American Metal Hose

AMERICAN METAL HOSE BRANCH OF THE AMERICAN BRASS COMPANY • General Offices: Waterbury 88, Conn.
Subsidiary of Anaconda Copper Mining Company • In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ontario*

THE ARGUMENT CORNER

Suggests Improvements In Steam-Line Anchoring

I READ WITH INTEREST R Manly Orr's solution of his steam-main expansion problem. I like Mr Orr's piping layout Fig. 1, and it no doubt will solve his problem, in which case my comments lose some of their effectiveness, but here goes.

Tying the two points on the line with a rod and turnbuckle may not completely achieve the end that Mr Orr expects. As shown in Fig. 2, when the pipe expands, its vertical leg tends to pivot about the rod connection at *Y* to open the flange at *X*. Also the rod connection does not provide for maximum flexibility inherent in the piping layout.

Expansion and contraction are being taken care of in a loop with one leg about 9 ft and one 8 ft long. In a 5-in. pipe line of the dimensions given, this loop is smaller than good practice dictates, especially when a 12-ft leg is being neglected.

I would suggest that if the pipe does not operate satisfactorily, Mr Orr keep the loop arrangement but support the pipe as in Fig. 4 to make better use of its inherent flexibility. Here the pipe is anchored horizontally at the elbow below the boiler header and just above the throttle valve, in guides that permit free vertical movement. The horizontal pipe run is supported midway between its ends on a spring hanger. This arrangement extends the vertical expansion leg almost to the throttle and anchors the pipe to keep strains off the throttle valve flange.

If the anchoring system, Fig. 4, cannot be readily installed connect the rod and turnbuckle as in Fig. 3. I prefer the anchors, Fig. 4, because the rod and turnbuckle, Fig. 3, expand and contract with changes in temperature.

Brooklyn, N. Y. ALAN M PALMER

On Junk and Japs

WITH INTEREST I NOTE Mr Miles' challenge, in August POWER, page 124, of George Edwards' attitude toward materials. In "Manhours vs Materials" Mr Miles has a theme worth discussion.

Not that I agree entirely on the dropped cork, the bent nail, or the snipped leads. But once, not far from your home and mine, there existed an acre covered with scrap iron known as the automobile graveyard. Although it sent men deep into the bowels of the earth in search of iron ore, American industry could not afford to clean up this mess of iron.

Yet the Japs could. They bought this junk at fair prices, and built machines to press it into bales for easy handling. They paid freight for a 2000 mile haul to West Coast ports. They loaded it into ocean freighters and shipped it another 5000 miles. Then they made this junk into tanks, trucks and ships which carried their fighting forces another 7000 miles; and into guns which poured death into the American ranks at Guadalcanal, Guam and Tarawa.

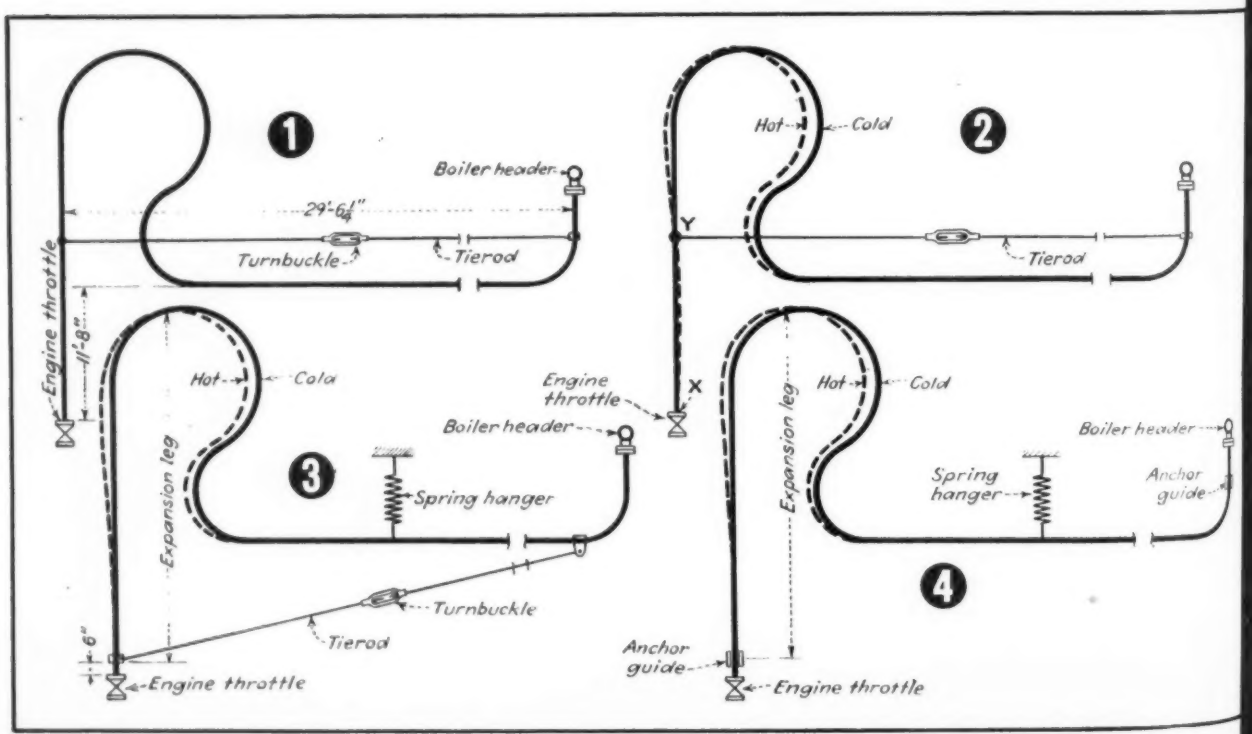
Yes, they hauled this junk 7000 miles to their plants—junk which an American plant a mile away could not afford to use.

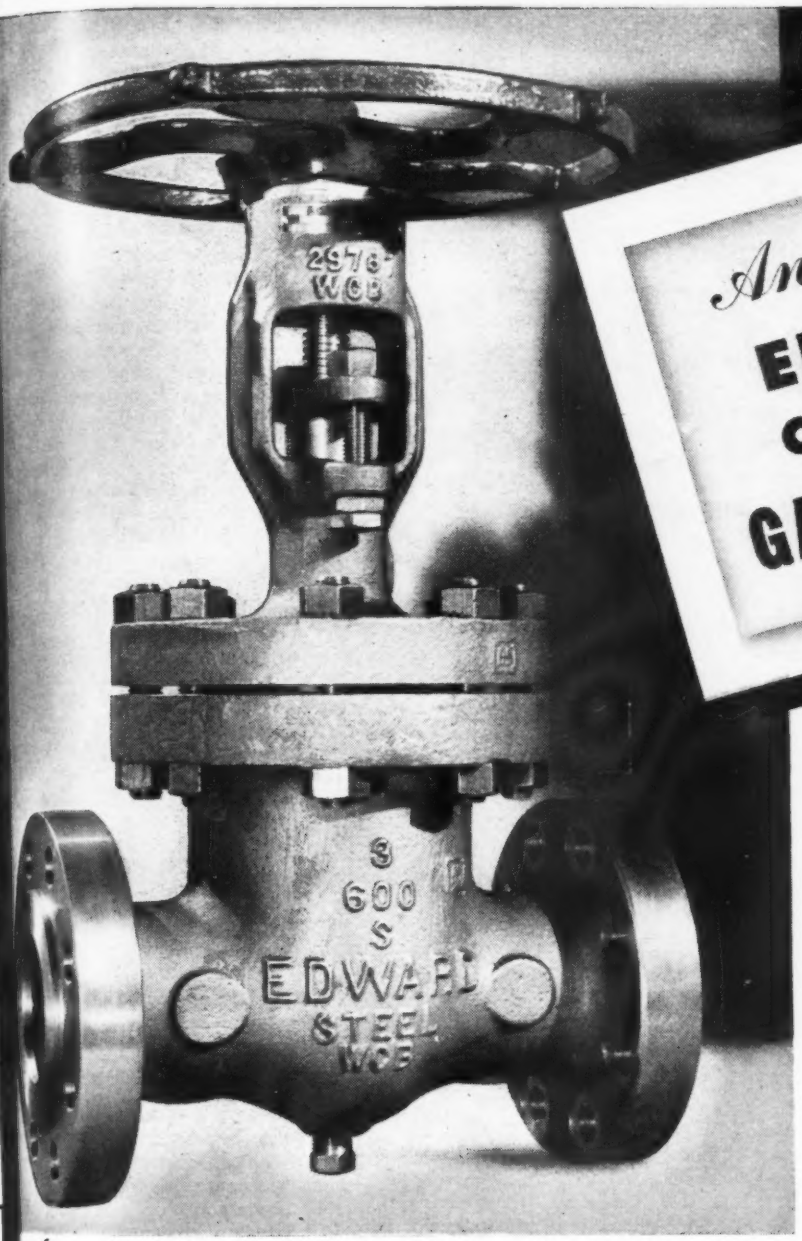
Marissa, Ill. GEORGE HOLMAN

Those Diesel Indicator Cards

WHEN READING ANYTHING on diesel-engine indicator cards, or listening to a talk on that subject I always reflect on the "rattling good job" I once served on. The ship was diesel-electric, and had four air-injection diesels of the Fullagar opposed-piston type. Each engine had four 14x16-in. cylinders, and at 250 rpm turned out 825 bhp; each was

(*Continued on page* 186)





Announcing

EDWARD CAST STEEL GATE VALVES

Now

YOUR POST-WAR GATE VALVE IS READY...!

HERE is a valve that *is* tighter and *stays* tighter than you thought a gate valve could—a post-war valve development ready *now!*

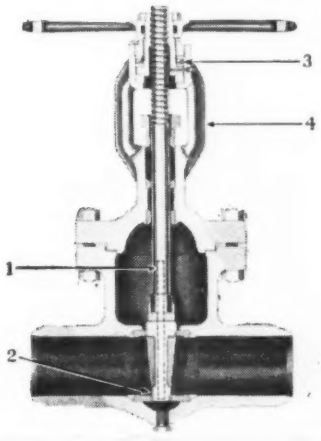
Forty years a producer of steel valves for difficult operating conditions, Edward is now building cast steel gate valves for the first time. These valves are available in many sizes and pressure classes for *immediate shipment!*

Flow is straight through and unobstructed, yet globe valve tightness is achieved through fundamental differences in design. Specially developed testing methods prevent any Edward gate valve passing test unless *both* faces, *not just one,* are absolutely drop tight *simultaneously.*

Check These

UNUSUAL FEATURES

1. Close fitting wedge guides welded to body *after* seat rings and wedge are located to assure perfect alignment and eliminate unnecessary wear-producing drag of wedge across seating faces.
2. Perfectly positioned hard surfaced seats, integral with body.
3. Simple yoke construction with ball bearing operation even in medium sizes, EValized surfaces where abrasion is a problem, and no superfluous parts.
4. One piece bonnet for absolute alignment, easy operation, minimized maintenance.



NEW CATALOG READY

Just off the press! Catalog 12-E1 with illustrations, dimensions and descriptions of Edward cast steel gate valves for 150 to 3600 lb service. Write for your copy.

THE EDWARD VALVE & MFG. CO. INC., EAST CHICAGO, INDIANA

EDWARD *Steel* VALVES

What's New in Plant Equipment

Compressor Gage and Controller

COMPRESSOR-TROL combines seven devices for control of compressor operations in a single, compact unit. It eliminates pipe and pipe fitting, simplifies installation and reduces possibility of air leakage. It is in $\frac{1}{2}$- $\frac{3}{4}$- and $1\frac{1}{4}$-in. sizes, determined by inlet connection. Instrument covers all control requirements of tank-mounted compressors up to 15 hp or 60 cu ft per min. It is equipped with Ashcroft Duraswitch, with either an electric or mechanical attachment for operating the 2-way unloading valve mounted on Ashcroft Compressor-Trol casting. Combined Ashcroft Duraswitch and gage has a heavy-duty gearless movement, slide-rule dial, a horizontal selfdraining and nonfreezing Bourdon tube. Entire gage is completely removable and replaceable. Compressor-Trol is furnished in all standard pressure ranges. *Electro-mechanical div, Manning, Maxwell & Moore, Inc, Bridgeport, Conn.*

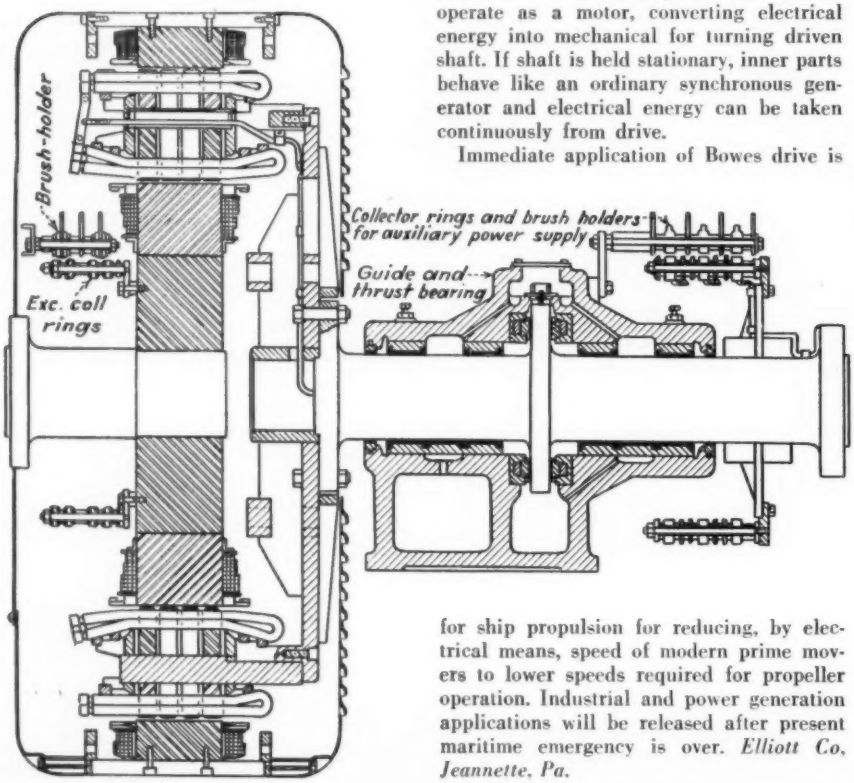
Voltage Regulator

E-M SYNCHROSTAT voltage regulator has new features: (1) Swing-door construction affords ease of inspection. (2) Semi-flush mounted cover designed for better appearance and for a more compact unit. (3) Panel mounting is simplified and no accurate fitting is required. With E-M *packaged* generator, regulator is installed in a metal inclosure with meters, mounted on and wired to generator. *Electric Machinery Mfg Co, Minneapolis* 13, *Minn.*

Three-Element Speed-Reducer Drive

BOWES ELECTRIC DRIVE reduces speed between modern high-speed prime movers and drive shafts for mechanical applications where gear and coupling are ordinarily necessary. Drive, built in reversing and nonreversing types, is available in sizes of 300 bhp and larger.

Engine element, which is a synchronous generator rotor with poles selected for desired speed ratio, is permanently attached to shaft of prime mover and revolves at normal engine speed. Shaft element consists of a rotating spider on which two armatures are concentrically mounted in relation to engine. Inner armature, together with engine, forms a generator. Its winding not only generates electrical energy, but also transmits torque to driven shaft. Outer armature makes use of stationary element field to operate as a motor, converting electrical energy into mechanical for turning driven shaft. If shaft is held stationary, inner parts behave like an ordinary synchronous generator and electrical energy can be taken continuously from drive.



Immediate application of Bowes drive is for ship propulsion for reducing, by electrical means, speed of modern prime movers to lower speeds required for propeller operation. Industrial and power generation applications will be released after present maritime emergency is over. *Elliott Co, Jeannette, Pa.*

Megohm Meter

ENTIRELY SELF-CONTAINED, megohm meter operates on 110-v 60-cycle ac. Model L-2 megohm meter is essentially a direct-reading ohmmeter, but incorporates a vacuum-tube voltmeter to cover relatively high-resistance values. Instrument checks leakage resistance of cables and insulating materials, locates defective insulation in equipment, measures carbon resistors, etc. Megohm meter also serves as condenser-leakage tester. Internal power circuit provides rapid charging of condensers under test. External battery voltage supply may be used for voltages other than the self-contained 200-v supply. Instrument may be operated with external voltages up to 1000. Internal resistance standards enable operator to check calibration and make necessary compensating adjustments. Using

internal 200-v supply, maximum range extends from 1 to 100,000 megohms in four overlapping ranges, but may be extended to 500,000 with an external 1000-v supply. Maximum resistance in series with condenser or insulation under test is said to be only 1 megohm. Balanced tube circuit and voltage regulators in internal power supply assure stability. Instrument is mounted on a sloping panel. Model L-2 megohm meter measures 8x15, 10-in. high and weighs 10 lb. *Industrial Instruments, Inc, 156 Culver Ave, Jersey City, N. J.*

Aluminum Solder

SHEET ALUMINUM can be lock seamed, or lapped and spot welded or riveted, and joint sealed with free-flowing soft solder. EutecRod 199. Improved rod supplants EutecRod 19B. With Autochemic Eutector flux 199, EutecRod 199 is said to flow on aluminum as readily as ordinary lead-tin solder on tin-plate, brass or copper. In long laps it makes moderate strength joints but is generally used as a seal. Rod works on cast as well as wrought aluminum, and on steel, copper and nickel alloys. EutecRod 199 is for applications where completed joint will not be heated over boiling point of water under working conditions. Its low temperature application makes it possible to join thin sheet metal without danger of

(*Continued on page* 146)

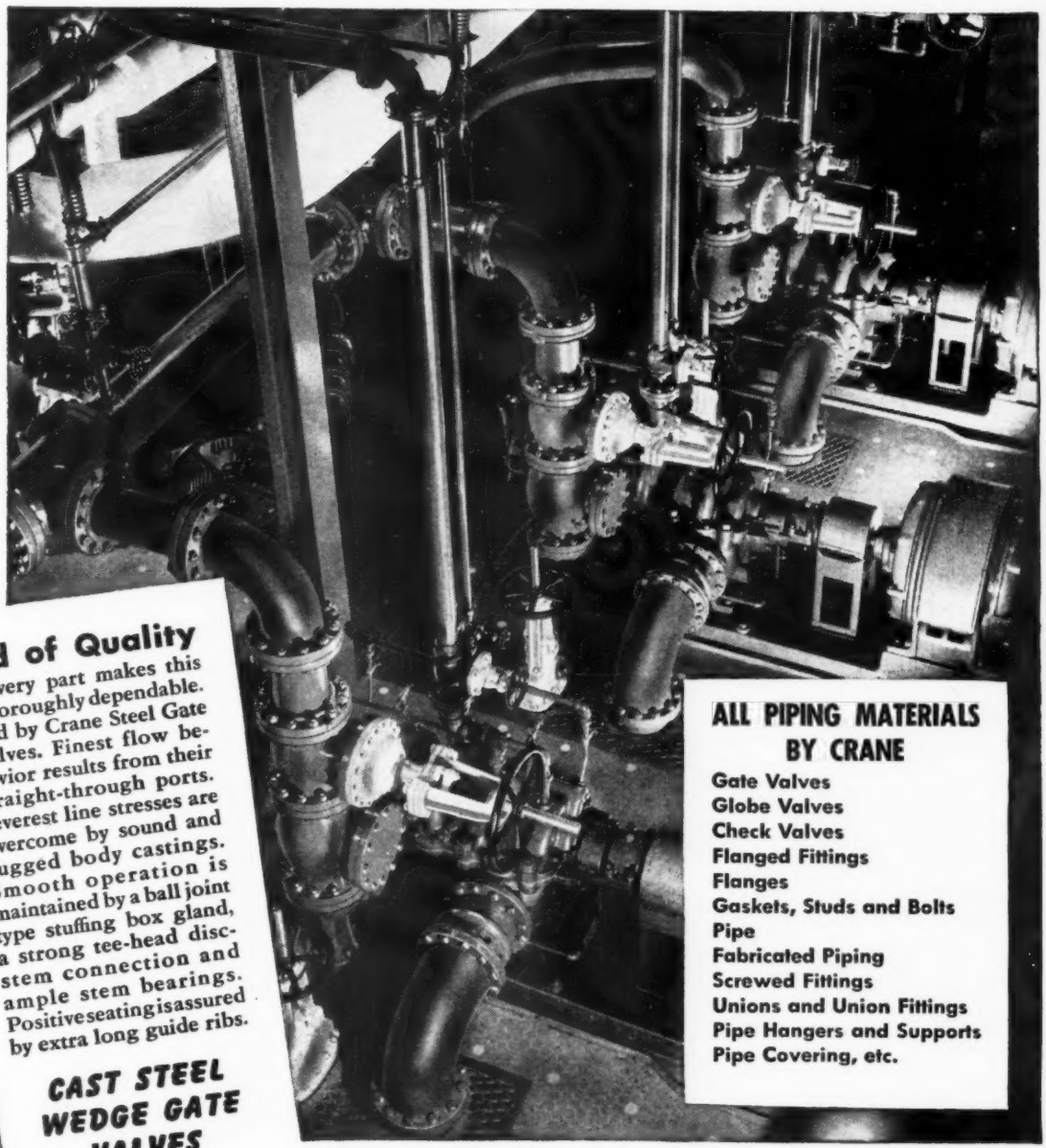
No matter what the service . . . CRANE supplies all Piping Needs

ONE SOURCE OF SUPPLY . . . ONE RESPONSIBILITY FOR ALL MATERIALS

For any power or processing installation—high, moderate, or low pressure—all your piping equipment needs can be filled at one source. Your Crane Branch supplies everything—valves, fittings, pipe, fabricated assemblies, and all piping accessories. With the world's greatest line of such materials, Crane insures proper selection for every service.

A primary factor of good installation, one responsibility for piping materials assures equal quality and craftsmanship in every part. Ordering, maintenance work, keeping of parts stocks and making replacements—all such operations are simplified when you use Crane *complete* materials service. And you're sure of getting full benefit of Crane Co.'s 89-year experience and leadership in the piping equipment field.

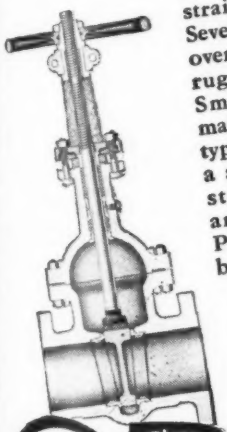
Crane Co., General Offices: 836 S. Michigan Ave., Chicago 5, Illinois. *Branches and Wholesalers Serving All Industrial Areas.*



Condensate and feed-water piping in a large power plant

One Standard of Quality

Adequate quality in every part makes this entire piping system thoroughly dependable. Such quality is typified by Crane Steel Gate Valves. Finest flow behavior results from their straight-through ports. Severest line stresses are overcome by sound and rugged body castings. Smooth operation is maintained by a ball joint type stuffing box gland, a strong tee-head disc-stem connection and ample stem bearings. Positive seating is assured by extra long guide ribs.



CAST STEEL WEDGE GATE VALVES

ALL PIPING MATERIALS BY CRANE

- Gate Valves
- Globe Valves
- Check Valves
- Flanged Fittings
- Flanges
- Gaskets, Studs and Bolts
- Pipe
- Fabricated Piping
- Screwed Fittings
- Unions and Union Fittings
- Pipe Hangers and Supports
- Pipe Covering, etc.

CRANE

VALVES • FITTINGS • PIPE

PLUMBING • HEATING • PUMPS

Horse-and-Buggy Engineers...

Newspapers and magazines report, day after day, all sorts of technical marvels that we civilians are to inherit once the war is over. There are electronic gadgets by the score, new lights, new power units, new tools, new steels, new alloys, new paints. Many are war proved, so we have that backlog of other men's experience to draw upon in deciding whether or not we can use them.

But the coming of peace will also release a flood of "postwar" products, developed whenever engineering departments could find the time. They will be rushed to market to fill the gaps left by canceled war orders. Some will be good, some bad.

This is just a word of caution. While most of us are as conservative as earlier engineers who forced Watt, Corliss and various diesel builders to put in engines "on trial" until they proved themselves, others are always rushing after the latest thing—just as a woman tries to outstrip (no pun intended) her neighbors on clothes. Our job, in each case, is to be sure *first* that the suggested new equipment will work and is worth the money—then to put it through, even though Grandpa may turn in his grave.

Any other attitude is just an attempt to throttle progress—and likely to be about as successful as King Canute's order to the tides to stop. All he got was wet feet and a deflated ego. In 1908, Nebraska tried the same thing with these traffic laws:

Clause 1: On discovering an approaching team, the automobilist must stop offside and cover his machine with a tarpaulin painted to correspond with the scenery. (Early use of camouflage).

Clause 2: In case a horse will not pass an automobile, notwithstanding the scenic tarpaulin, the automobilist will take his machine apart as rapidly as possible and conceal the parts in the grass. (Ease of dismantling our specialty).

Clause 3: Automobiles running on the country roads at night must send up a red rocket every mile and wait ten minutes for the road to clear.

Clause 4. They may then proceed carefully, blowing their horns and shooting Roman candles (like New York's law—still in force—that a train moving on tracks on a street must be preceded by a man on horseback with a red flag).

Had such laws been enforced, Nebraska would still be a horse-and-buggy state. If we set up similar ones for our plants, we'll end up as horse-and-buggy engineers.

George Edwards
Engineer

You'll find 1000 uses for these packings

J-M Wick and Rope Packings are useful for emergencies—*anywhere*

IT'S GOOD SENSE to have some Johns-Manville Asbestos Wick and Rope Packings handy for emergencies or for general use anywhere. There's no end to the ways in which these packings can prove valuable to you.

With its own source of supply from the world's largest asbestos mine, J-M has complete control of the quality of J-M Packings and is able to supply a wide range of styles to meet all needs.

For complete details on these and other useful J-M Packings, write for the J-M Packings Catalog. Johns-Manville, 22 East 40th Street, New York 16, N.Y.

3 TYPES

J-M Asbestos Wick Packing—twisted asbestos material that's easily handled and highly heat-resistant. Useful anywhere, especially for packing small valve stems on exhaust lines, heating systems; for caulking cracks in retorts, ovens, and boiler walls.

J-M Twisted Asbestos Rope Packing (illustrated above) is larger in diameter but otherwise similar to J-M Asbestos Wick. Asbestos Rope conforms readily to irregularities and is easily worked and compressed. Use it for packing, caulking or gasketing wherever a thicker material than Asbestos Wick is required.

J-M Braided Asbestos Rope has a firmer, more compact structure. It thus stands up better to abrasion and to severe usage over long periods of time. Use it as groove packing or for insulation on flexible or curved heated piping—wherever the use requires a dry, heat-resistant packing which can take rough usage.

JM PRODUCT

Johns-Manville PACKINGS & GASKETS

THERE'S A J-M DISTRIBUTOR NEAR YOU

POWER NEWS

BUSINESS ITEMS AND APPOINTMENTS • WASHINGTON NOTES

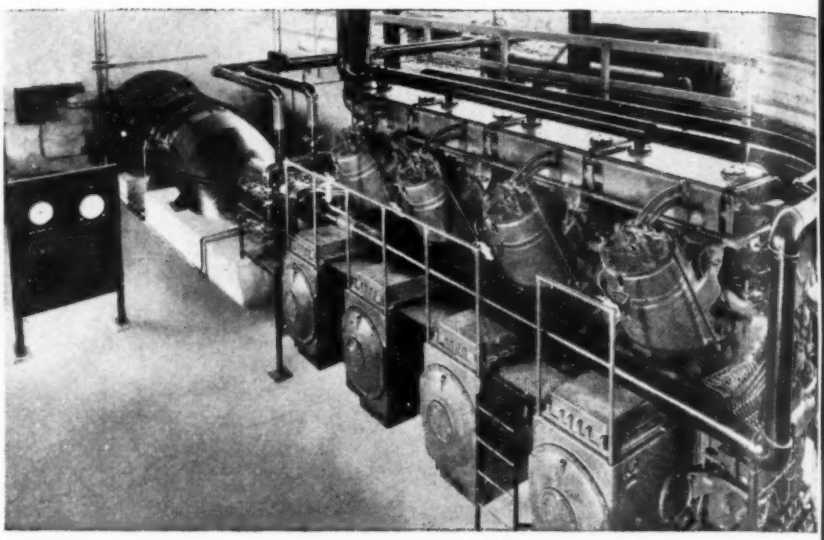
CONVENTIONS • WAR AND POSTWAR POINTERS • COAL MISCELLANY

Preform Wiring On Switchboards

For working out in detail a method of preform wiring on switchboards and other control equipment, Westinghouse recently presented the largest suggestion award in its history to two employees at its East Pittsburgh plant. W L Jackson, who conceived the idea of preforming jigs, was presented a check for $1832.25 and John Downes, who helped Mr. Jackson work out the various wiring details, was awarded $610 for his contribution.

Previously, when each switchboard was wired individually, all mechanisms and instruments had to be mounted on the panels. Floor space to set up each unit and services of skilled wiremen had to be available. Not only was the manpower situation critical, but the assembly area was not large enough to meet the Navy's demand.

Now, with no diagrams to follow, semi-skilled wiremen can work faster than skilled men did before, panels can be wired in a productionlike manner. Because switchboards do not have to be assembled before wiring can be started, cables can be preformed and hung on racks to await installation.



One of the 8-cylinder gas engines at Port Neches plant of Butane Products Co

Gas Engines Pump 360,000,000 Gpd

At Port Neches, on the Texas gulf coast, two gas-driven 8-cylinder Cooper-Bessemer engines pump 360,000,000 gpd for the new $45,000,000 Port Neches butadiene plant. See photo above. This plant produces at its peak 120,000 long tons of Buna S rubber annually.

Water for cooling and processing comes from the Neches River, a mile distant, flows through condensers and cooling equipment and then returns to the stream. Volume of water can be judged by the fact that the conduit necessary is 9 x 22 ft. Specially designed screens prevent debris and fish from entering the pumps.

According to Cooper-Bessemer engineers, operation of two gas engines of this size represents one of the largest installations ever made solely for pumping water to a single manufacturing or processing plant, and is particularly significant because the heavy load is carried by the two gas engines without standby power.

AMIDST THE RUINS OF JAP POWERHOUSE

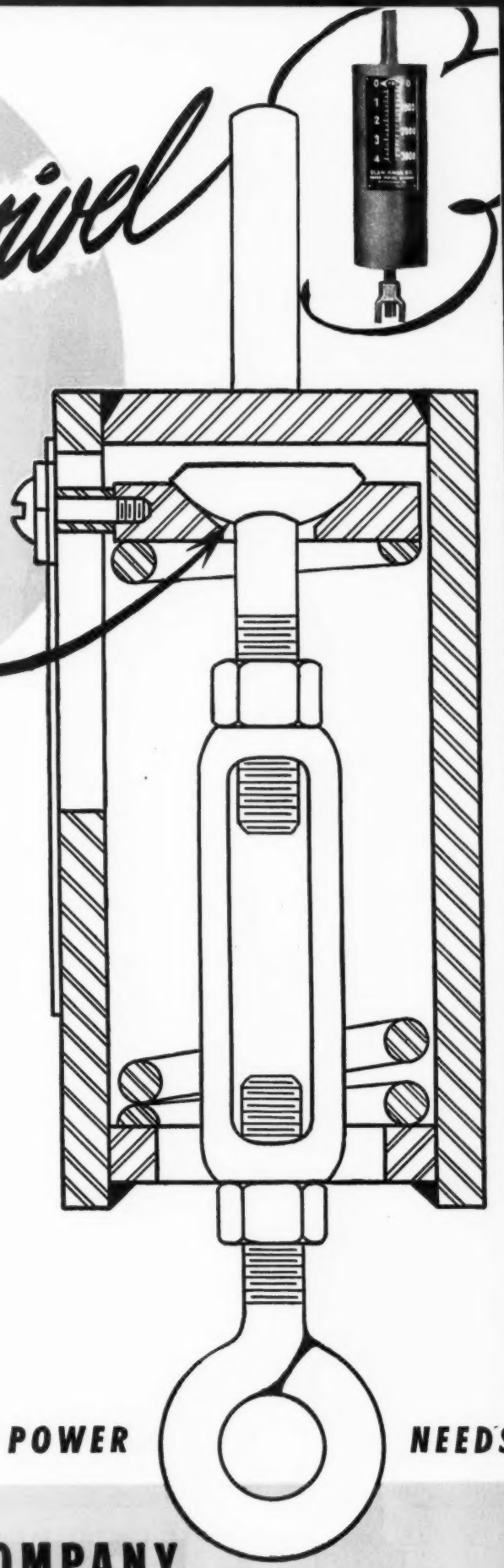
On Saipan, amid the ruins of a Jap powerhouse for a radio station, which is now being used as the Second Division hospital, U. S. Marines attend Catholic Mass offered by Father C C Riebel, Chaplain *Wide World Photo*

Coal Miscellany

Bituminous coal stocks in the hands of consumers on July 1 totaled an estimated 59,681,000 tons, marking the second consecutive month of increases in

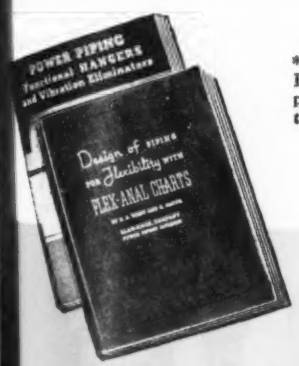
(*Continued on page* 144)

Exclusive Internal Swivel action



POWER PIPING
FUNCTIONAL HANGERS

- **SCALE**—Actual load indicated in Lbs. at all times.
- **SPRINGS**—Totally enclosed and guided.
- **ROD**—Pivotal action, swings freely with complete lateral and longitudinal movement, permitting short headroom installation. This internal swivel action is a patented feature.
- **SHORT HEADROOM**—Turnbuckle adjustment *11⅛" minimum for any load.



*FLEX-ANAL CHARTS and HANGER BULLETIN 1863 save time in engineering manpower. Copies of these books can be obtained through a request on your business letterhead.

FIT ALL MARINE & POWER NEEDS

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POWER PIPING DIVISION
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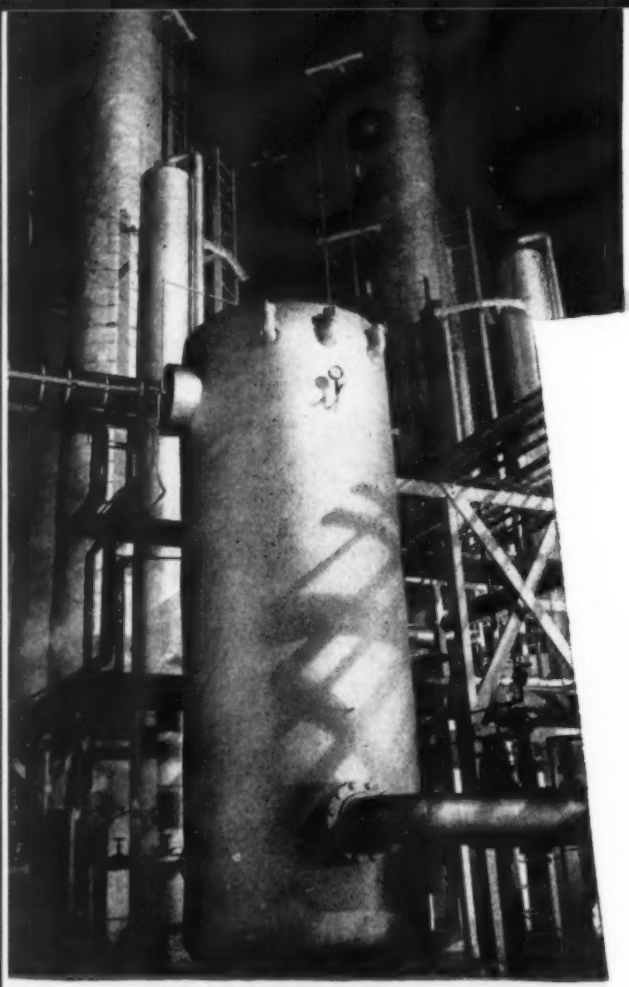


Where Valves

COMMERCIAL SOLVENTS CORPORATION

TERRE HAUTE INDIANA

August 10, 1944.

Mr. R. B. Osgood, Manager
Jenkins Bros.
1514 West Fulton Street
Chicago 7, Ill.

Dear Mr. Osgood:

Thank you for your letter of August 8, with reference to the "LIFE" magazine article on Penicillin, which described our new plant.

The Jenkins Valves which appear so frequently in the illustrations have played a creditable part in the successful operation of the plant at better than rated capacity.

About two out of every three valves in the plant are Jenkins Valves, 1673 in all. This percentage is highly significant, especially since we required many special valves which you do not make. We used a wide variety of Jenkins Valves -- steel, stainless steel, and bronze, in sizes from 1/8" to 12".

Our approval of Jenkins Valves for many of the critical services in this vital new plant was prompted by their service record in other plants of Commercial Solvents Corporation, where their performance has been completely satisfactory, both in peacetime, and under severe conditions of war production.

Very truly yours

COMMERCIAL SOLVENTS CORPORATION

M. C. Wheeler

M. C. Wheeler
Production Manager

MCW-md

1673

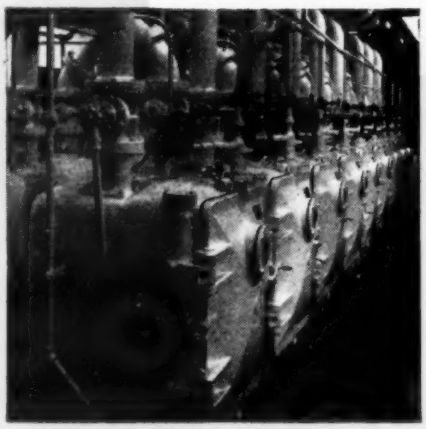
JENKINS VALVES

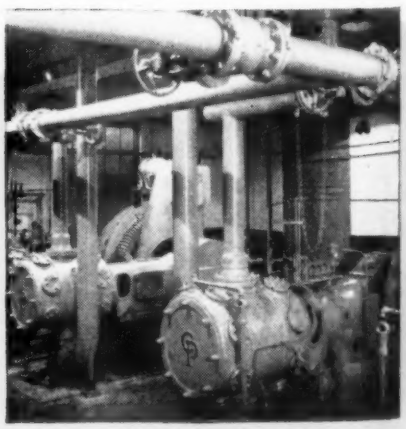
provide dependable control points in miles of complex piping

In the deep fermentation process used at the CSC Penicillin plant, a 12,000 gallon batch of fermentation liquid is concentrated to about 15 gallons. This solution yields about 4.5 to 5.5 pounds of the dry product.

The designed capacity of the plant is 40 billion Oxford units monthly, and output is already exceeding the goal. This production is sufficient to treat from 8000 to 350,000 patients, depending on the severity of infection.

Dependable control of the fermenting, centrifuging, refrigerating, high vacuum, and other special equipment is absolutely essential to maintain full production. The many Jenkins Valves used match the efficiency of the complete plant, which has been repeatedly declared by experts to be a "modern industrial miracle".





JENKINS VALVES

SINCE 1864

...control Life, for millions...

PENICILLIN'S first large-scale producers rely on the proved merit of Jenkins Valves

The world's first large scale plant for Penicillin production, operated by Commercial Solvents Corp., is a notable example of the genius of American scientists, engineers, and construction experts working as a team. An entirely new project in chemical plant construction, handling a product of extremely temperamental nature, the plant was put in operation less than five months after construction began.

But it is more than a brilliant technical achievement. It is the hope of fighting men and civilians everywhere, who, denied the healing magic of Penicillin, would have been condemned to suffering and death.

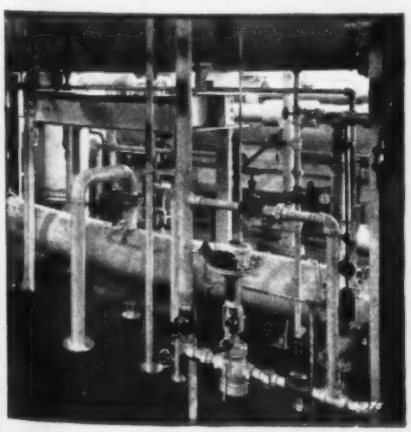
The operation of every bit of equipment in the plant has a direct bearing on the speed with which Penicillin can be made available to waiting millions.

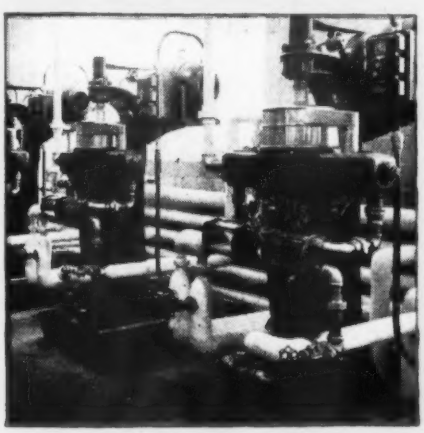
That is why all equipment was chosen on the basis of proved performance. The use of Jenkins Valves in such large numbers is a well-earned tribute to Jenkins standards of better design, better materials, better workmanship.

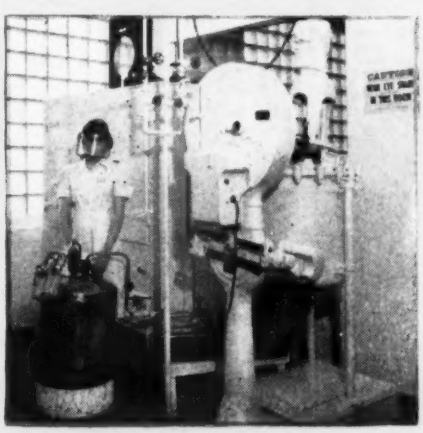
This proved dependability of Jenkins Valves, so important here to operations, is an equal advantage in low maintenance – the reason why Jenkins "cost least in the long run".

Specify Jenkins Valves in your plans for reconversion and renovation.

Jenkins Bros., 80 White St., New York 13; Bridgeport, Conn.; Atlanta; Boston; Philadelphia; Chicago; Jenkins Bros., Ltd., Montreal; London.







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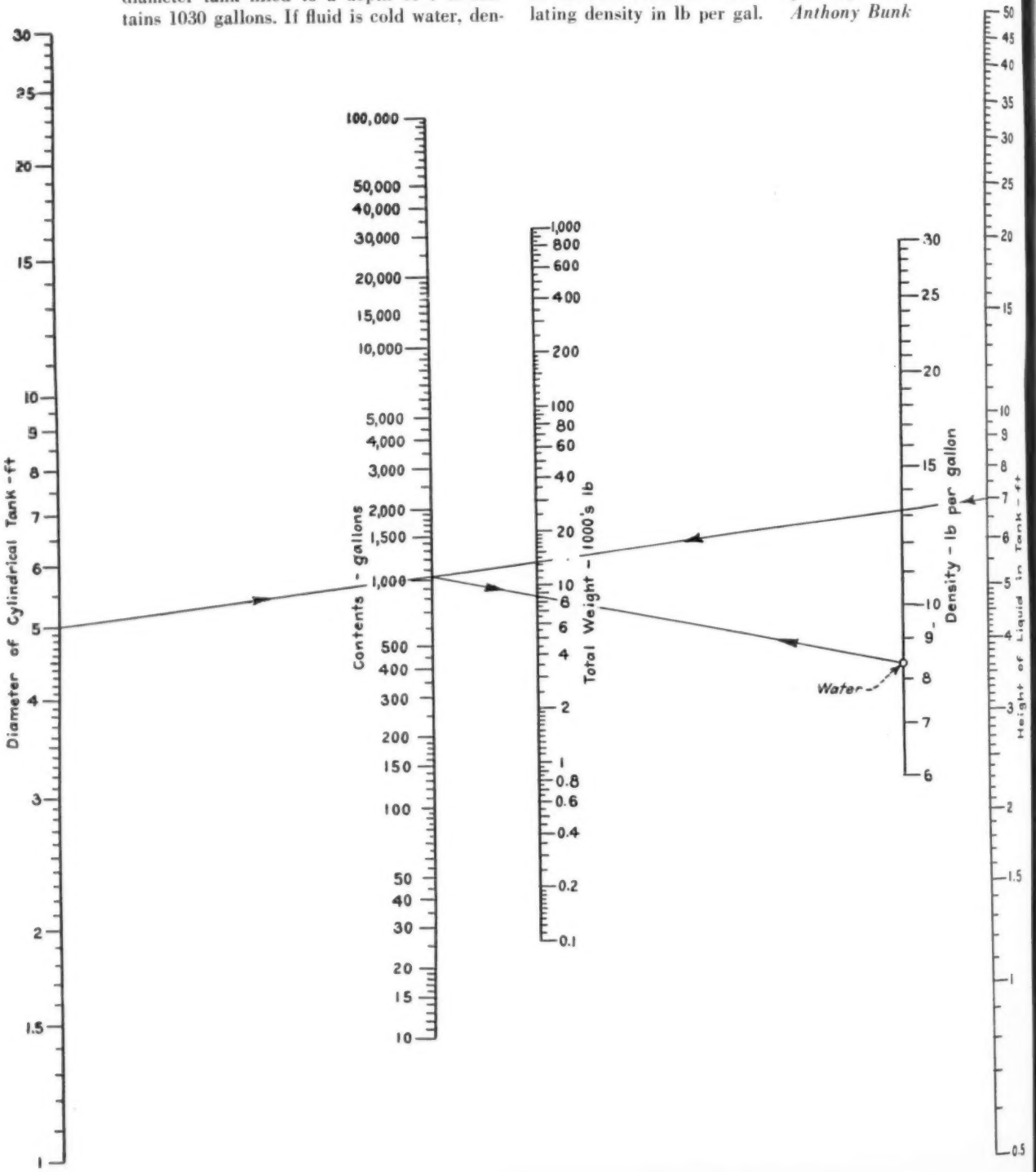
BRONZE · IRON · STEEL

FOR EVERY INDUSTRIAL, ENGINEERING, MARINE, PLUMBING-HEATING SERVICE

Number 146

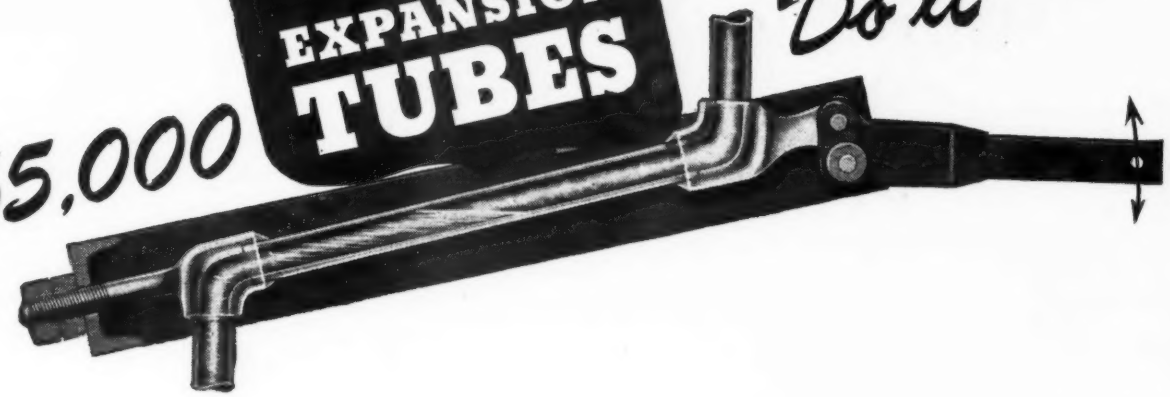
Cylindrical Tank Capacity Chart

► FIND VOLUME AND WEIGHT of fluid in vertical cylindrical tanks directly by alignment of values on this chart. For example, a 5-ft diameter tank filled to a depth of 7 ft contains 1030 gallons. If fluid is cold water, density 8.3 lb per gal, tank contains 8600 lb. Volumes in cu ft can be obtained by using the conversion factor 7.48 gal per cu ft; chart can be used for solids as well as liquids by calculating density in lb per gal. *Anthony Bunk*


Diameter of Cylindrical Tank - ft
Contents - gallons
Total Weight - 1000's lb
Density - lb per gallon
Height of Liquid in Tank - ft
Water

© POWER

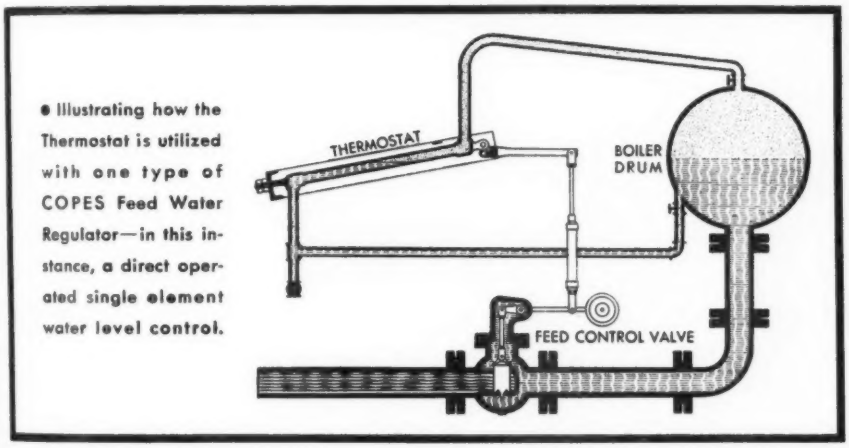
65,000 EXPANSION TUBES Do it --



THIS represents the COPES Thermostat—the boiler water level responsive element of more than 65,000 COPES Feed Water Regulators.

Aggressive research for 35 years has failed to uncover any other device as ideal for the purpose.

True, many mechanical improvements have been made. Frequently there are new adaptations to solve specific problems. Several styles are available for different types of COPES Regulators. But fundamentally the COPES Thermostat is still unchanged and unequalled.



• Illustrating how the Thermostat is utilized with one type of COPES Feed Water Regulator—in this instance, a direct operated single element water level control.

How It Operates

An inclined metal tube is mounted between two channels of a rigid steel frame. One end of the tube is anchored to the frame; the other end is attached to an angle type lever.

The interior of the tube is connected to the boiler drum similar to a water column, steam filling the upper part, and water the lower part. Corresponding water levels always exist in the tube and the boiler.

The water filled part of the tube is relatively cool due to radiation. Therefore when the water level lowers, permitting more hot steam to enter, the average temperature of the tube increases. The tube *must* expand. Conversely, with a rise in water level, the tube *must* contract. This movement, amplified by the lever, operates the feed water control valve either by direct mechanical transmission or by pilot valve fluid transmission.

Outstanding Advantages

1. SIMPLE. Just an alloy tube and lever. No floats, stuffing boxes, pressure chambers, liquid charges, fins, orifices, or concealed parts.

2. DEPENDABLE. Utilization of an unbreakable natural law without structural complication.

3. FULLY AUTOMATIC. Repeats performance continuously without periodic attention.

4. POWERFUL. Recall your own experiences with the tremendous forces developed by expansion and contraction.

5. RESPONSIVE. Grasp a pipe and shoot live steam into it. How quickly will you let go? Tests prove the COPES Thermostat responds to level changes 5 to 8 times faster than other devices.

6. ACCURATE. Minute changes in water level cause the tube to react as if by micrometer adjustment. All movement is transmitted smoothly with no lost motion, since working parts are kept in tension by weight or spring loading.

7. STURDY. Built to withstand use and abuse.

8. LONG-LIVED. Usually outlasts the boiler.

9. NON-FOULING. No fins to catch dust or dirt. Condensate keeps interior clean and scale free.

10. ADJUSTABLE. Nuts at the fixed end of the tube permit easy adjustment of water level setting *with the regulator in service.*

11. ADAPTABLE. Performs indoors or outdoors with climatic temperature from −40° to +110°F. Available in all pressure standards and several types to meet space requirements of any installation on land or sea.

Assures Superior Results

The superiority of the COPES Thermostat is just one important reason why COPES Feed Water Regulators provide the maximum of Safety and Economy.

Why not consider COPES for your boilers? A free survey, gladly made by our engineers at your invitation, may point the way to substantial benefits.

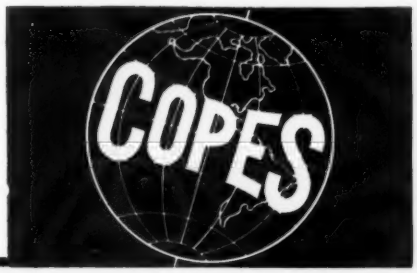
For detailed information on COPES Feed Water Regulators, write for Catalog 12-41.

NORTHERN EQUIPMENT CO.

1041 GROVE DRIVE • ERIE, PENNSYLVANIA

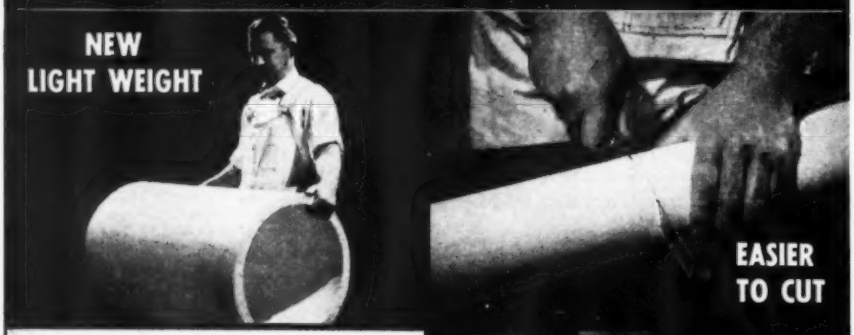
Feed Water Regulators • Liquid Level Controls
Pump Governors • Differential Valves • Reducing Valves and Desuperheaters

BRANCH PLANTS IN CANADA, ENGLAND
REPRESENTATIVES EVERYWHERE



New LIGHT-DENSITY TYPE PRECISION MOLDED 85% MAGNESIA

BRINGS EASIER, FASTER, MORE ECONOMICAL APPLICATION



The new, patented* Plant Precision Molded process brings out to a new degree the natural insulation superiorities of 85% magnesia!

Plant Precision Molded 85% Magnesia hits a new low with its light weight of only 11 lbs. per cubic foot, with resultant lowering of thermal conductivity over the full range of temperatures!

Plant Precision Molded 85% Magnesia is molded to exact final size and thickness. All its surfaces are smooth; and the ability of purposely-broken small pieces to hold together makes for neater jobs and less "clean-up" after installation. WRITE TODAY for complete descriptive data.

PLANT
PRECISION
MOLDED
85% MAGNESIA
"THE DEPENDABLE STANDARD—MODERNIZED"
REG. U.S. PAT. OFF.

Army-Navy "E" Awarded to FACTORY No. 3 Emeryville, Calif.

*U. S. Patents Nos. 2,131,374, 2,209,752, 2,209,753, 2,209,754.

PLANT RUBBER & ASBESTOS WORKS

MAIN OFFICE: SAN FRANCISCO

Sales Offices in Los Angeles, Wilmington, and Oakland, Calif.; distributors in principal cities. *Factories* in Emeryville, San Francisco, and Redwood City, Calif.

Manufacturers of Plant Insulating Materials and Mechanical Packings Since 1920

COMPLETE RANGES OF SIZES and thicknesses in blocks and pipe coverings (up to and including 18-inch pipe size in sectional form. Larger sizes in segmental form).

Questions and Answers

(*Continued from page* 118)

gen and carbon dioxide, which would cause corrosion in the boiler, are also driven off in an open heater and vented to the atmosphere.

Open heaters usually contain filtering compartments to retain the precipitated impurities and also any other solid matter that may be in the feedwater.

Q 21—What is the action in a closed heater?

A—It is sometimes possible to raise the temperature high enough in a closed heater to cause the most troublesome impurities, the sulphates of lime and magnesium, to solidify and precipitate, as well as the carbonates of lime and magnesium which deposit at a much lower temperature. Sulphates remain in solution up to 300 F, at which temperature they solidify and settle. As these impurities may form a hard scale on the heater tubes it is not particularly profitable to use a closed heater as a water purifier. Water containing these impurities should be chemically treated before it passes through the heater.

Q 22—Sketch and describe any type of open feedwater heater.

A—A common type of *direct-contact* open heater, using exhaust steam to heat the feedwater, is shown in Fig. 3. The entering steam passes the oil baffle on the side and mingles directly with the water, which enters at the top and trickles down over the trays. The purpose of the trays is to break the water up into a great number of fine streams and thus allow it to mix more intimately with the steam. The heated water

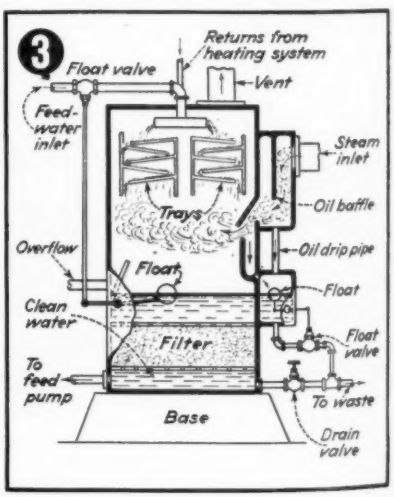
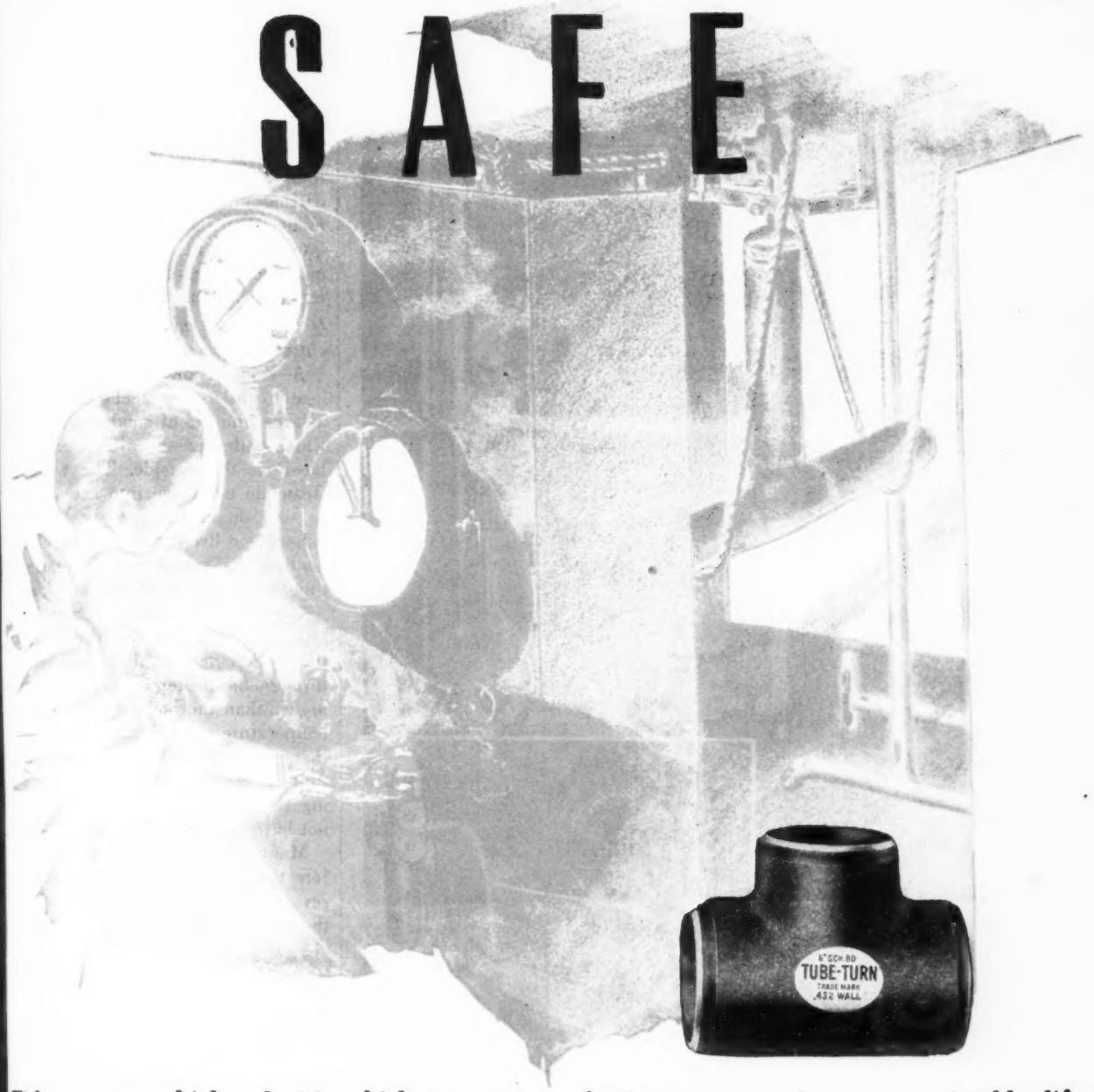


Fig. 3—In the "open" feedwater heater the water to be treated makes direct contact with the heating steam. Operation is usually near atmospheric pressure, heating water close to 212 F

SAFE



High pressures, high velocities, high temperatures . . . stresses and strains, corrosion and erosion . . . *all* factors which tend to undermine safety in piping are resisted by *Tube-Turn seamless welding fittings.*

Laboratory and field tests conducted regularly demonstrate how Tube Turns' *exclusive* forging processes increase serviceable life by improving grain structure in the metal itself, and thus reduce wear at the most vulnerable points of a piping system — where flow direction changes! Write for Catalog 111 — it contains data valuable to all who buy, specify and install piping and welding fittings.

VALUABLE WALL CHARTS

Dimensional data on Tube-Turn fittings and flanges are shown on these two handy wall charts, sizes 24 x 36 inches—sent free on request.

Selected Tube Turns Distributors in every principal city are ready to serve you from complete stocks.

TUBE TURNS (Inc.) Louisville, Kentucky. Branch Offices: New York, Chicago, Philadelphia, Pittsburgh, Cleveland, Dayton, Washington, D. C., Houston, San Francisco, Seattle, Los Angeles.

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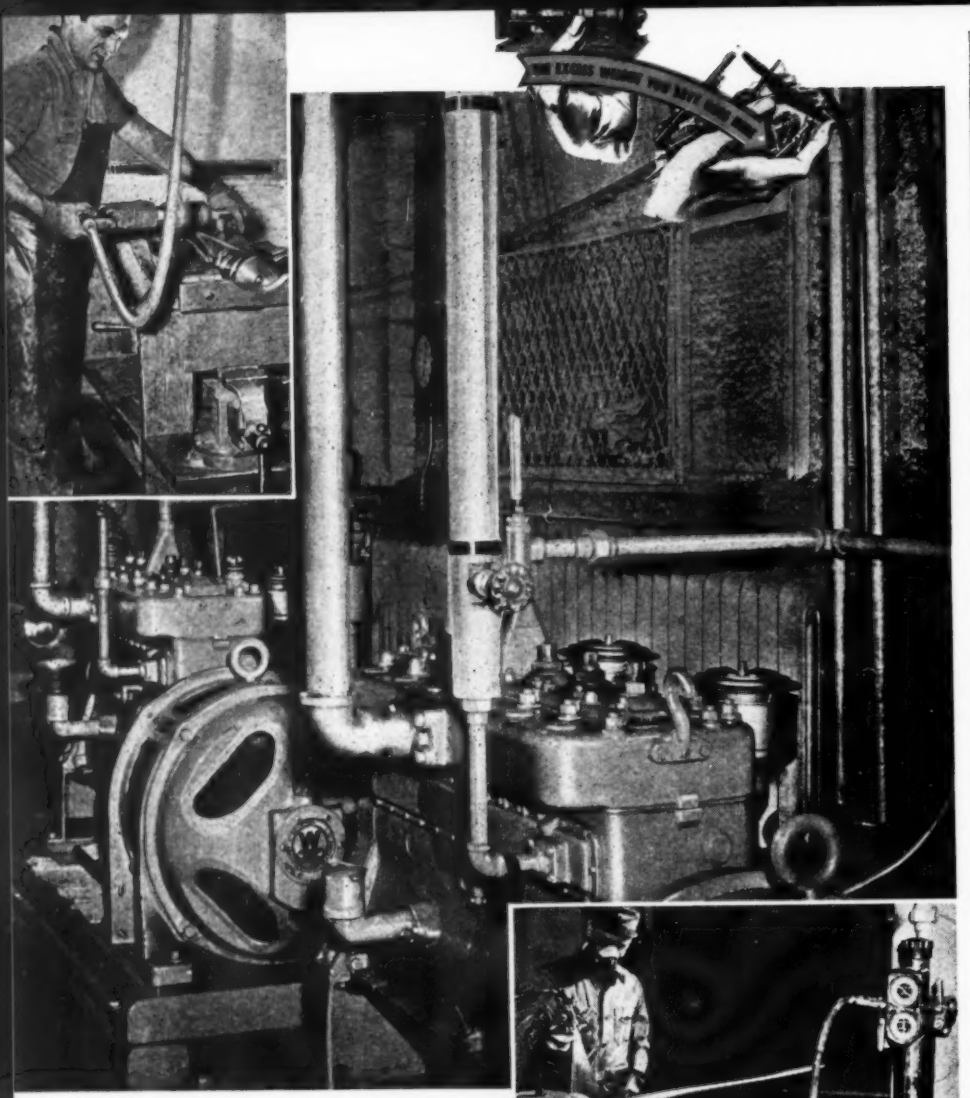
Welding Fittings and Flanges



Here's An Air Compressor *for many uses*

This illustration shows a Schramm Air Compressor furnishing air for anding and paint spraying airplane propellers.

chramm stationary units fit the need for compressors that can do a ariety of jobs in industrial and power plants.

heck these uses to which you can put Schramm in your plant: operating illing and drilling machines . . . chipping and calking hammers . . . leaning engines and generators . . . sand blasting grooving bearings . . cleaning boiler flues . . . and every other pneumatic tool requirement. rite today for latest bulletin.

SCHRAMM INC. THE COMPRESSOR PEOPLE WEST CHESTER PENNSYLVANIA

passes through a coke filter before entering the pump suction. An overflow pipe is provided to prevent flooding of the heater. A float-controlled valve holds the water level constant.

The feed pump must be placed at a lower level than the heater as the pressure in the pump suction is always less than atmospheric. If the temperature is carried too close to the boiling point in the open heater the water will flash into steam in the suction line and pump cylinders unless heater level is many feet higher than pump suction.

Q 23—Sketch and describe one type of closed feedwater heater.

A—Fig. 4 shows a common type. This heater consists of a steel shell containing a large number of small tubes through which water passes while steam circulates on the outside. The water and steam do not come into actual contact as they do in the open heater. Either exhaust or live steam can be used for heating the water, but live steam for this purpose does not save any fuel.

The closed feedwater heater is usually placed between the feed pump and the boiler. Hence the water passing through the heater is under a pressure higher than the boiler pressure and its temperature can be raised much higher than in an open heater. With this arrangement, water is heated after leaving the feed pump, so the pump does not have to handle the heated water.

Many plants use an open heater before the pump and a closed heater (or several closed heaters in series) after the feed pump.

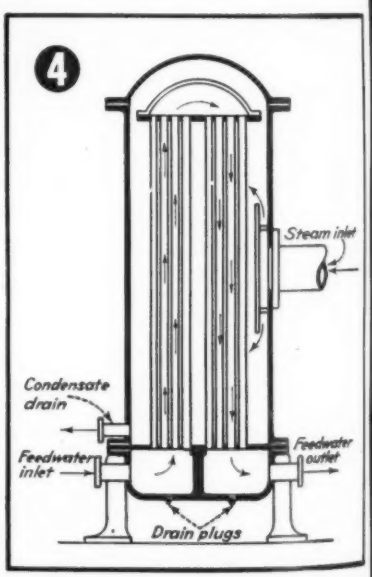


Fig. 4—In the "closed" feedwater heater, water and heating steam are separated by tube walls. Closed heaters can be operated at any desired pressure on either steam or water side

Heard about Chapman's new List 960 gate valve ?

It's replacing Chapman's standard List 960 small forged steel gate valve of the rising outside screw type, and is designed to give even longer service. And here's why:

☛ Bonnet now fitted with a substantial forged steel yoke. A flanged forged steel packing gland is provided, thereby eliminating exposed threading on valve yoke, thus giving immunity from rusting and corrosion when placed in exposed locations.

- Stems, plugs, and seat rings *on all valves* are heat treated stainless steel to insure greater working qualities.
- Swivel bolts are used for holding the packing gland.
- No gaskets to blow, as in valves with flanged bonnet connections.

Specify List 960 outside screw type in carbon steel for working pressures to 800 lbs. at 750° F. Or in alloy steel for service at 1000 lbs. working pressure at 750° F. Both valves available in screw and welding ends. Where service conditions make it preferable the List 960 rising stem inside screw type is available.

For greater pressures — get Chapman *List 990* with heavier walls and extra strength. In sizes up to and including 1½", with screw or welding end.

LIST 960 PACKS IN MORE SERVICE!

The Chapman Valve Mfg. Co., Indian Orchard, Mass.

The "FRAHM" VIBRATING-REED HAND TACHOMETER . . .

requires no contact with the rotating element and is unique for measuring speed of totally enclosed machines and other equipment where the end of the shaft is not accessible. The only mechanism is a set of accurately tuned steel reeds which vibrate by resonance according to the speed of the machine with which the instrument is held in contact.

For hand use in servicing, installation and maintenance work; also built in types for permanent mounting. Various ranges available from 900 to 30,000 r.p.m.

Write for descriptive Bulletin 1590-P.

The JONES HEAVY DUTY HAND TACHOMETER

is used for indicating r.p.m. and surface speeds of all types of machinery in which the moving parts are readily accessible. Simple, rugged and reliable, it is built to maintain accuracy in hard, everyday service. Single and triple range models up to 12,000 r.p.m. supplied complete with carrying case and accessories.

Write for descriptive Bulletin 1710-P.

. . . The JAEGER SPEED INDICATOR

is a "vest-pocket" speed-measuring device which adds up the number of revolutions over a period of six seconds and shows the revolutions per minute without any calculations. Can also be used to measure speeds in feet per minute. Available in two models—for all speeds up to 2000 r.p.m. and for all speeds up to 10,000 r.p.m. Supplied complete with carrying case and accessories.

Write for descriptive Bulletin 1750-P.

JAMES G. BIDDLE CO. **1211-13 ARCH STREET PHILADELPHIA 7, PA.**

Design Practice

(*Continued from page* 100)

belt wrecked from this cause. Before a belt is thoroughly broken in it is more likely to fail even at light loads than an older one at full load; for the new belt is less elastic than the older one and its fibers have not had time to work to a position that gives maximum belt strength.

When designing high-speed belt drives we keep idler's natural oscillating frequency down to less than one third that of the belt's stretch-and-contraction frequency. Then, one frequency breaks up the other and the idler cannot oscillate. To reduce the frequency of the idler, extend its swing arms above the pulley bearings and add weight at their top ends, Fig. 5. We also increase the length of springs until under normal load natural frequency about equals that of the idler. A design can be calculated to obtain proper relationship between natural frequencies, or it may be arrived at by trial and error.

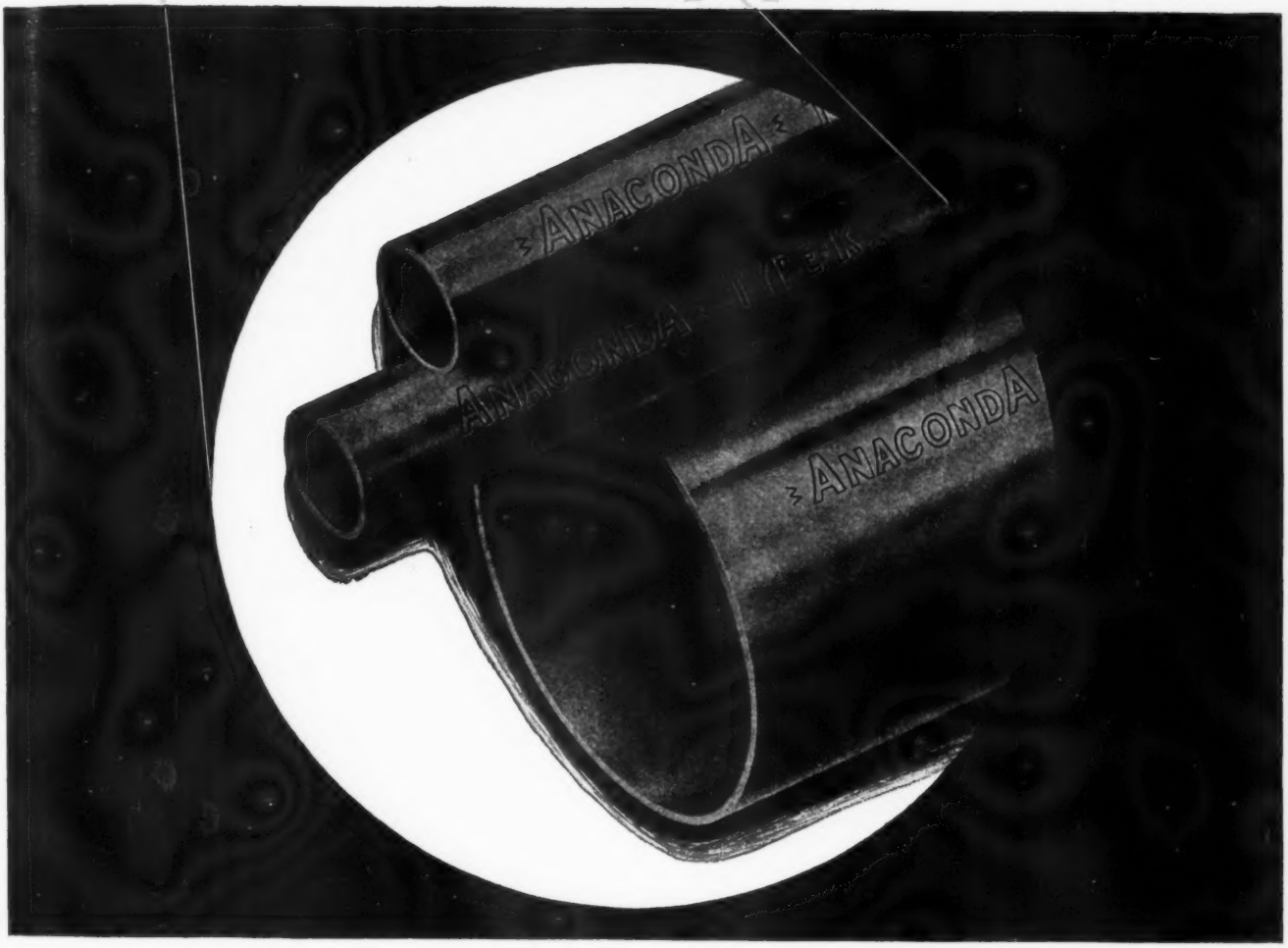
With synchronous oscillations eliminated, sudden load change is the only possible cause of a wave or jump in the belt, as in Fig. 3 and 4. When a high-speed belt has correct tension, which should be considerably higher than for normal drive, the spring-actuated idler quickly eliminates the wave before effects are serious.

To keep unit weight, flexibility and thickness uniform, and thus avoid centrifugal force changes that might propagate waves or oscillations, a manufacturer should know when he is building a belt for high-speed service. When dressing such belts, be careful to maintain uniform friction and elasticity.

Following these rules greatly increases rod-mill belt life and establishes records of tonnage rolled even for less expensive oak-tanned leather. Also, belt stretch is reduced by eliminating or greatly reducing heavy shocks when the drive is not properly designed and operated. Thus, salvation of an 80-mile-per-hr flying belt with its phenomenon of planing or becoming a projectile is to provide scientific inducement for it to flow steadily from one pulley to another; in other words, prevent vibrations or waves that shorten life or even destroy the belt.

Dr Edward U Condon, associate director of Westinghouse research laboratories, has been elected to membership in the National Academy of Sciences for his outstanding contribution to the field of science.

LONG LIFE *Copper...*



Reduces Pipe Corrosion Costs

CORROSION CAN BE an expensive charge against manufacturing costs. It piles up losses in man-hours, production and increases plant maintenance. Industries which have used corrosion-resistant copper tube lines have found them to be the soundest kind of investment.

Anaconda Copper Tubes retain their smooth interiors—minimizing flow resistance and reducing pumping costs. The longer tube lengths, which can be bent around obstructions, effect a considerable saving in number of joints and fittings. Solder-type fittings reduce installation time, and can be readily disassembled and reinstalled when alterations require pipe-line changes.

The use of copper is curtailed today. But it will pay you to plan for the time when this rustproof metal and its alloys are available once more. Publication C-24 describing industrial applications of Anaconda Copper Tubes will be sent you on request. 4463

ANACONDA *Anaconda Copper Tubes*

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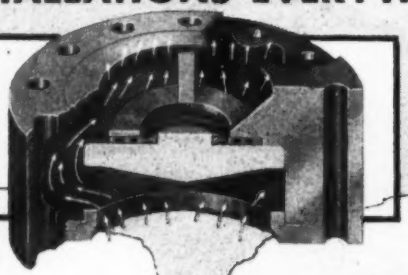
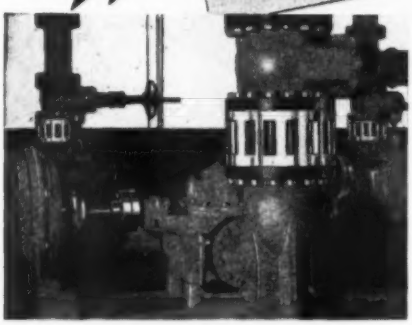
COSTLY, DESTRUCTIVE "WATER HAMMER"

WITH INSTALLATIONS EVERYWHERE!



WILLIAMS-HAGER

FLANGED Silent CHECK VALVES



Three 10"-300 lb. Williams-Hager Flanged Silent Check Valves in Radio City, N. Y.

Eliminates

Costly Breakdowns in Pumps and Piping Systems with Operating Pressures up to 6000 lbs!

Williams-Hager Flanged Silent Check Valves completely eliminate "Hammer" and "Bang" in the lines, provides uninterrupted constant flow of liquids.

Unlimited in size or application, from 1" to 20", built of materials to best suit the end use, Williams-Hager Flanged Silent Check Valves have been chosen for years as standard equipment in such exacting line uses as oil, gasoline, acids, water, chemicals, gas, salt water, brine, etc., etc., regardless of temperature.

Write today for interesting folder on "Water Hammer—Cause, Effect and Control in Piping Systems."

THE WILLIAMS GAUGE COMPANY

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Pump Governors . . . Steam Traps Feed Water Regulators . . . Water Columns

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WPB Eases Procurement of Power Equipment

An extension of the war power program under which generating, transmission and distribution facilities may be added, enlarged or improved beyond the limited extent heretofore permitted has been instituted by the Office of War Utilities, to become effective immediately.

OWU will assign AA-3 ratings to projects applied for by utilities which can show need for extra reserve capacity; fuel or operating manpower savings; extreme hardship; inadequate equipment or substantial reduction of service hazards.

The new program is limited by the amount of extra materials made available by WPB's Requirements Committee, and can be shut off without notice if military reverses again require all possible material or manufacturing facilities. No such shut-off is anticipated, however.

Unlike the war power program which has been administered by OWU since 1941, the materials recently made available are not earmarked for specific jobs in carefully-selected areas, but rather will be available for the most deserving cases in the entire industry.

Availability of materials and manufacturing facilities was the primary reason for approval of the "supplementary program" at this time, but the move also was predicated on the fact that the electric utility industry has been operating for several years under an extremely rigorous downhold on new installations. WPB approval is recognition that the new program will in no way interfere with direct war production.

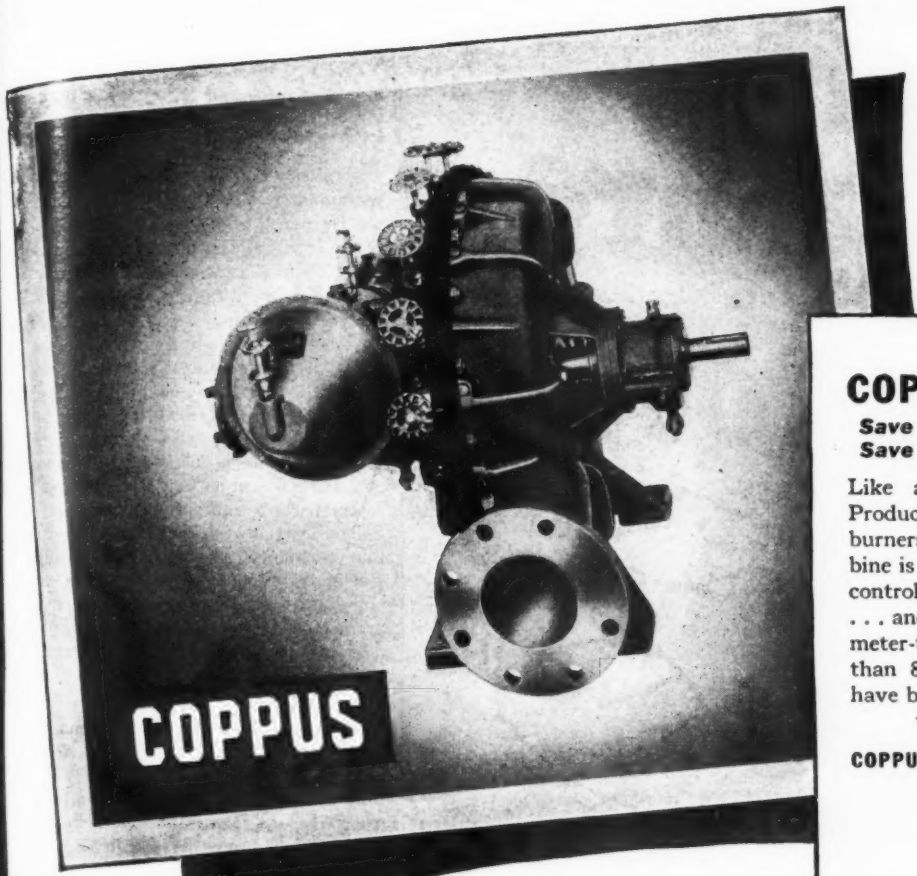
Where new generating facilities are applied for, consideration will be given to fuel savings and to the desirability of larger margins of reserve capacity.

Generally in determining where the new program will apply, consideration will be given to replacement of inadequate or obsolete equipment where this will bring a substantial reduction of service hazards.

OWU Director Edward Falck described the new program as aimed at making good, now that the war production situation permits, on the equipment which normally would have been installed by utilities within the last three years but which was ruled out because of the materials and manufacturing capacity shortages. OWU policy throughout has been to relax restrictions whenever their need could no longer be demonstrated.

Acceptance of the new program by the Army and Navy is a recognition that the need for rehabilitation of utility systems is greater than the need for unrestricted civilian production aimed either at filling civilian needs or at preventing unemployment.

In addition, the time required to complete system engineering, design and order electric equipment and get it installed is so much longer than that required by most other types of non-war production that the problem must be attacked now to show any results during the first half of next year, when, it may be assumed, non-war production will have increased tremendously over present levels.



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Save Metal in Wartime — Will Save You Money in Peacetime

Like all Coppus "Blue Ribbon" Products (blowers, ventilators, gas burners, etc.), the Coppus steam turbine is a precision-made product . . . controlled by Johansson size blocks . . . and every turbine is dynamometer-tested before shipment. More than 85% of all orders since 1937 have been repeat orders.

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DESIGNED FOR YOUR INDUSTRY...ENGINEERED FOR YOU

If a COPPUS "Horse Power" Steam Turbine can power your pump, blower, fan, stoker, dryer, mixer, etc. . . . then you'd waste money and metal buying an "Elephant Power" Turbine. COPPUS Blue Ribbon Turbines come in 6 frame sizes; matching size to job saves critical metal for war and money for yourself.

And the blue ribbon means workmanship that promises peak performance.

prevent pressure losses

• In force-feed lubrication of bearings, use *babbitt-tipped* Laminum shims to prevent oil and pressure losses. Shims cut to your specifications provide accurate laminations for quick precision adjustment.

Shims cut to your specifications. Stock shim materials obtainable from your dealer. Write us for further information and shim application chart.

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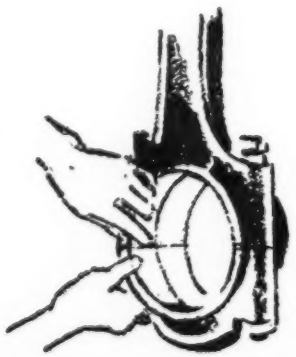

it's

LAMINUM

TRADE MARK

THE SOLID SHIM THAT *peels* FOR ADJUSTMENT

Power News

(*Continued from page* 130)

stockpiles after 17 months of almost uninterrupted decline, Solid Fuels Administrator Harold L Ickes announced.

Addition of 4,388,000 tons to storage during June was made possible by usual lower summer consumption, production being sustained. Stocks, however, are still 14,394,000 tons below the amount in storage in 1943.

Administrator Ickes said that soft-coal stockpiles must be substantially enlarged to provide adequate protection against emergencies next winter; and that in spite of the larger total, essential groups of consumers still have inadequate protection and many war-important individual consumers have dangerously low stocks. He further stated that consumers have the responsibility of storing as much coal as they can now secure, and should accept whatever usable grades and sizes are available instead of delaying in the hope that preferred coal may be obtained later.

Utilities and industrial plants using high-grade, special-purpose coals for steam generation will lose most of the 1,680,000 tons of this fuel which must be diverted at the mine to coke plants and by-product users whose stocks have fallen to dangerously low levels. Utilities and industrial users appeared most likely to suffer diversions since they, on a nation-wide basis, hold bituminous stocks well above normal levels. Some of the diversions are expected to come from the proceeds of the 10 percent cut ordered some time ago in deliveries of Districts 7 and 8 coals for domestic use. However the SFA statement said, in announcing diversions, that no further cut of civilian allocations of these coals is as yet anticipated.

The diversion program is necessary to protect steel production and by-product users, Acting Interior Secretary Abe Fortas said. Diversions will be made from well-stocked purchasers so as to minimize neces-

(*Continued on page* 194)

KENNEDY
BRONZE GATE VALVES

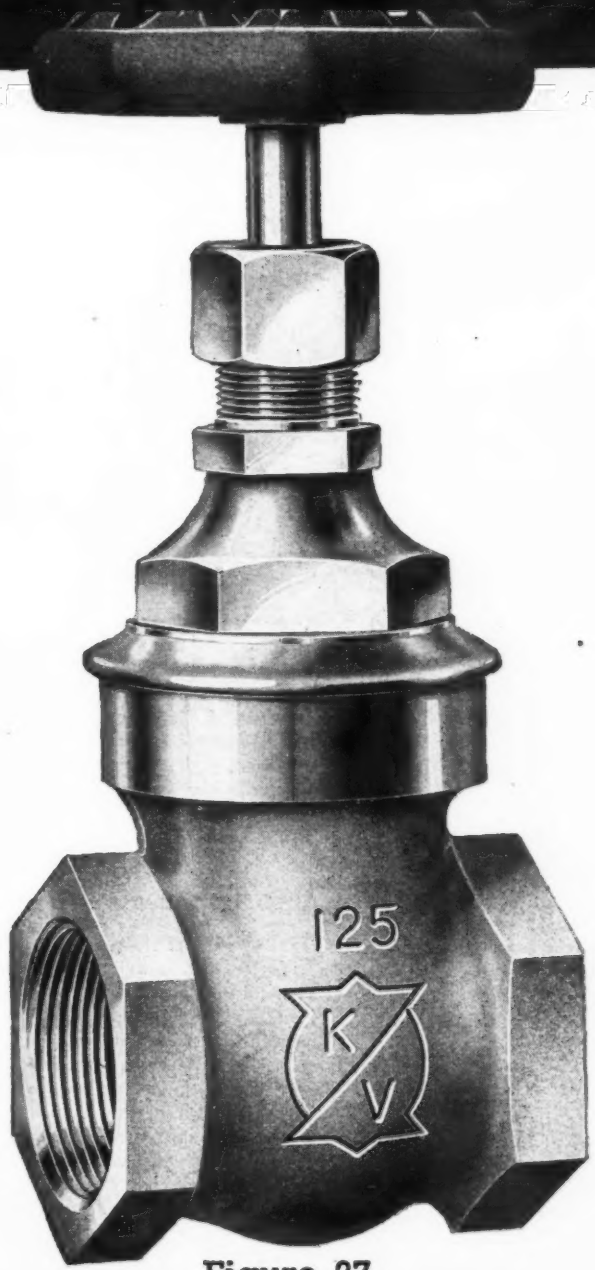

Figure 27
Standard, Screwed Ends

Simple
Sturdy
Durable

Assure easy operation, and lastingly trouble-free service. Available in non-rising and rising stem types; also outside screw and yoke. Built for steam pressures up to 300 lbs.

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ELMIRA, N. Y.

R/M KEEPS THE STREAM ON THE BEAM

Just as a ringmaster keeps a show on the go, R/M packings keep liquids on the flow. Every R/M packing is engineered to be the best and most lasting product for the job it has to do. When super-heated steam starts bubbling, when pumps begin to lose pressure, when gases leak, or oil drips, there is an R/M packing designed to whip them back into line.

Government demands for R/M packings will gradually be relaxed as the end of the war approaches. Be sure to ask for R/M products whenever they are available.

R M

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MANHEIM, PENNSYLVANIA

Bridgeport, Conn. ★ North Charleston, S. C. ★ Passaic, N. J.

MAKERS OF PACKINGS FOR EVERY INDUSTRIAL USE

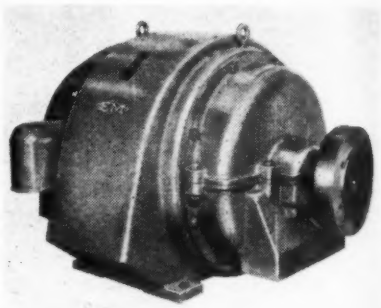
New Equipment

(*Continued from page* 126)

distortion. If cast iron is first *tinned* with zinc-base solder, EutecRod 199 bonds to it. *Eutectic Welding Alloys Co, 40 Worth St, New York 13, N. Y.*

Plastic Tape

FIBRON IS FOR INSULATING wires, cables and electrical equipment; for splicing cables; and for protecting wiring, piping and equipment exposed to caustic or corrosive fumes, oil, grease, acids, alkalis or moisture. Flexible and elastic, Fibron tape is manufactured from Vinylite resin. It is heat sealing, flame resistant and high in dielectric and mechanical strength. *Irvington Varnish & Insulator Co, Irvington 11, N. J.*



Induction Motors

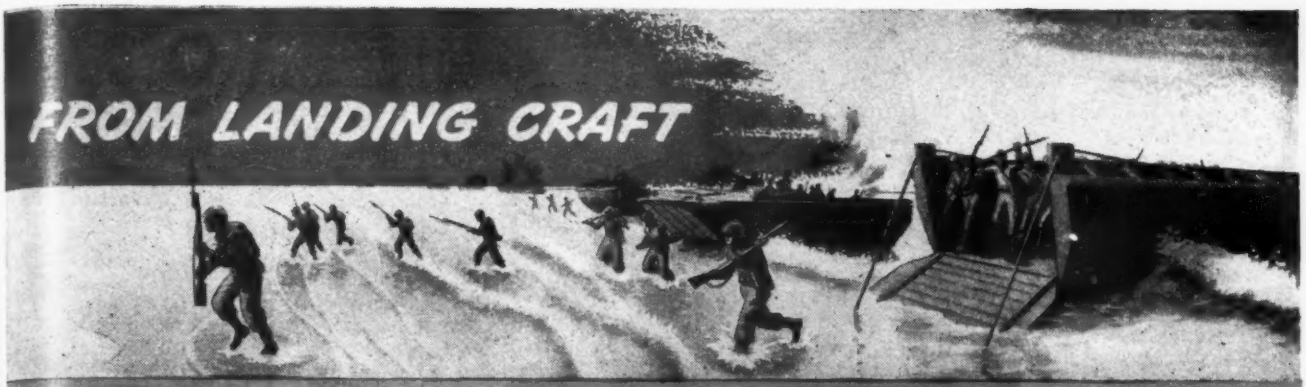
LARGE, HEAVY-DUTY INDUCTION MOTORS, for industrial, power-plant, waterworks and other drives, range in size from 200 to 1000 hp in squirrel-cage and wound-rotor models. Modifications may be supplied to meet specific power-service and motor-application conditions. *Electric Machinery Mfg Co, Minneapolis 13, Minn.*

Latex Insulation

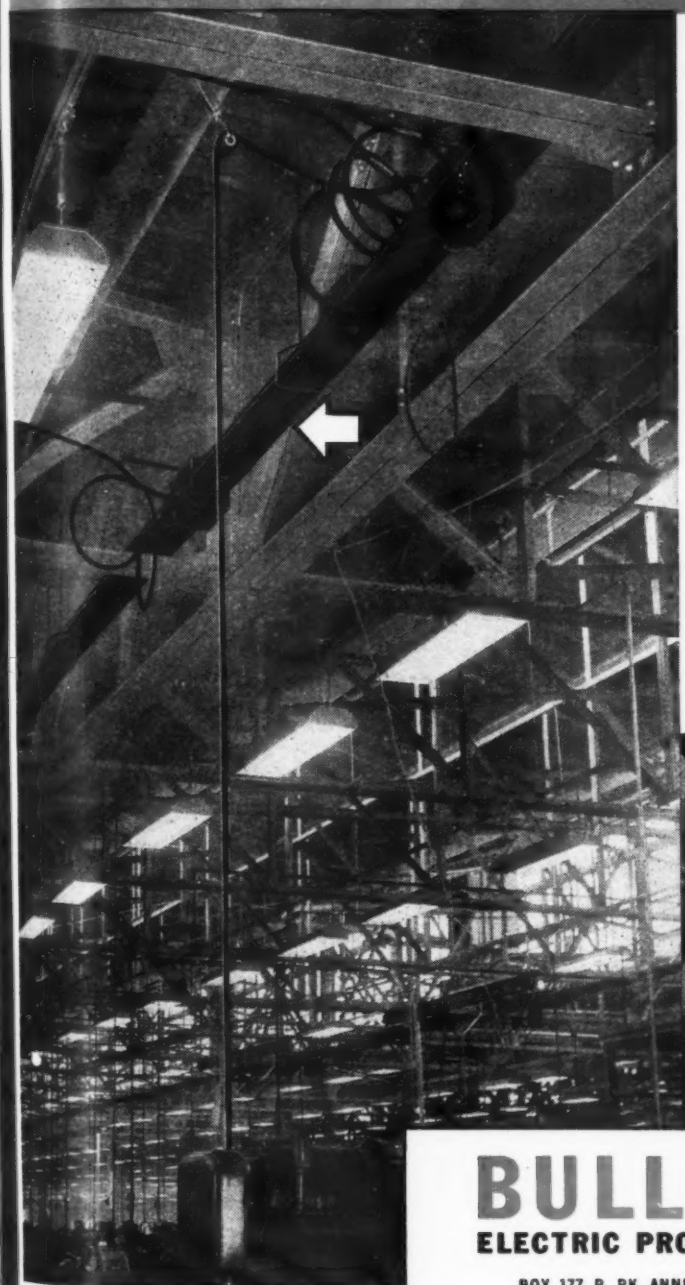
NUBUN IS A SYNTHETIC RUBBER latex insulation for power, lighting and communication cable. Qualities of Nubun, cited by manufacturer, include flexibility, impermeability to water, laminated construction and perfect conductivity centering to produce an insulated wire of maximum conductivity and minimum diameter. Synthetic insulation is said to be exceptionally homogeneous following vulcanization and has high electrical characteristics, such as dielectric strength and insulation resistance. Nebun insulation is made from a special modification of Buna S synthetic rubber. *U. S. Rubber Co, Rockefeller Center, N. Y.*

Electronic Oscillograph

ELECTRICAL PHENOMENA too rapid for observation by any other means is said to be caught by new electronic oscillograph. A 50,000-v electron beam generated in a cold cathode tube impinges directly upon fixed or rotating photographic film to give a



...BACK TO PEACETIME PRODUCTS



BULLDOG WILL SPEED RECONVERSION

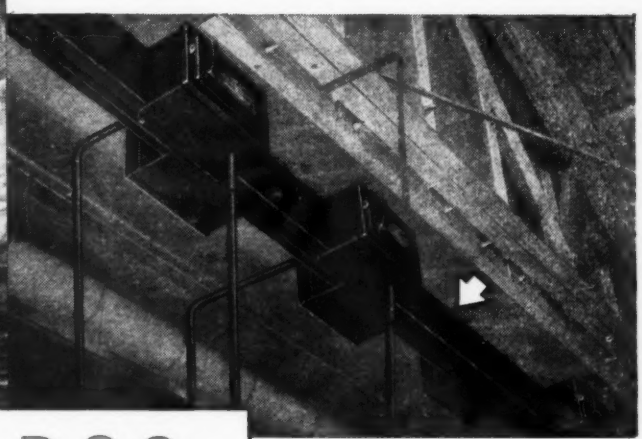
In the great war conversion race, BullDog Electrical Distribution Systems have cut weeks — even months — from change-over schedules. Maintenance time and cost were slashed. Output was stepped up, safety improved.

The reason? BullDog Bus Duct systems make plug-in power for machines immediately available for any shop set-up—furnish mobile power for portable tools, cranes and hoists — provide completely flexible lighting.

Looking ahead, BullDog-equipped plants can also count on speedier, easier reconversion to peace production.

Now is the time to plan for the *reconversion* race. We offer the help of expert BullDog engineers, and will gladly send complete literature.

There's a Big Job Ahead — Buy More War Bonds



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VACU-BREAK SAFETY SWITCHES • SWITCHBOARDS • SAFTOFUSE PANEL BOARDS • CIRCUIT MASTER BREAKERS • UNIVERSAL TROL-E-DUCT • INDUSTRIAL TROL-E-DUCT.

BULLDOG
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BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of Canada, Ltd., Toronto, Ont.

Field Engineering Offices in All Principal Cities

BullDog BUStribution DUCT provides complete flexibility on branch power circuits. The plug-in feature enables you to change production machines at will — rearrange whole departments without interrupting production elsewhere.

PRODUCTS OF COMPLEX
Welding Procedures

Although Associated does not engage in volume production of welding elbows the above units (small part of the total) were fabricated in our shops . . . and thereby eliminated a potential stoppage. The related work called for 4-6 chrome welding ells in 6" 8" 10" 12" 14" sizes—something a bit beyond the average welding ells. In order to expedite the job we determined to proceed with the fabrication of the ells. Such welding requires more than ordinary torch work. Correct procedures may be termed complex. Delay was avoided because of ability, equipment —and material on hand. Had this been your job you, too, would have been pleased.

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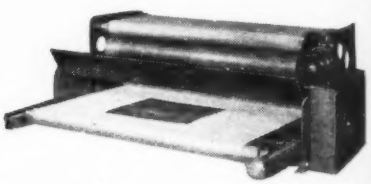
2332 East 38th Street • Los Angeles 11, California

ASSOCIATED *Progressive* PIPING

sharp, detailed record of electrical phenomena lasting as little as a fraction of a millionth of a second. Photoelectric control for exposing the film carried on rotating drum insures exposing film for one revolution only, although drum speed is variable within a wide range up to 7000 rpm. *Westinghouse Elec & Mfg Co, Pittsburgh, Pa.*

Metallizing Gun

TYPE 3E is for high-speed production spraying of low-melting-point metals. Using ⅛-in. zinc, tin, lead, solder, babbitt, cadmium or fine-gage copper and copper alloys, manufacturer claims gun exceeds any spraying speeds yet attained with these metals. Rates of deposition, in lb per hr, include: zinc—40, tin—70, lead—110, solder—90, babbitt—75. *E* or 2E guns may be converted to new Type 3*E* and 3*E* may be converted back to standard *E* or 2E. *Metallizing Engrg Co,* 38-14 30*th St. Long Island City* 1. *N. Y.*



Print Dryer

THE B-8 ELECTRICALLY HEATED DRYER, in two sizes, handles prints of 26- and 44-in. widths. It has variable-speed-drive motors and controllers, which permit instantaneous speed changes over a range of 6 in. to 3[illegible] ft a min, thus accommodating all work under various drying conditions. Current consumption is small. *Peck and Harvey,* 4327 *Addison St, Chicago* 41. *Ill.*

Frequency Meter

MODEL 21-FX METER supersedes J-B-T Model 21-F. Because it is more compact, the new model makes frequency measurement for portable equipment, air-borne units and miniature panelboards. Only one clearance back of panel has to be figured, simplifying the design problem. Meter is said to meet ASA C39.2-1944 for electrical indicat-

IN THREE YEARS

. . . NO MAJOR REPAIRS

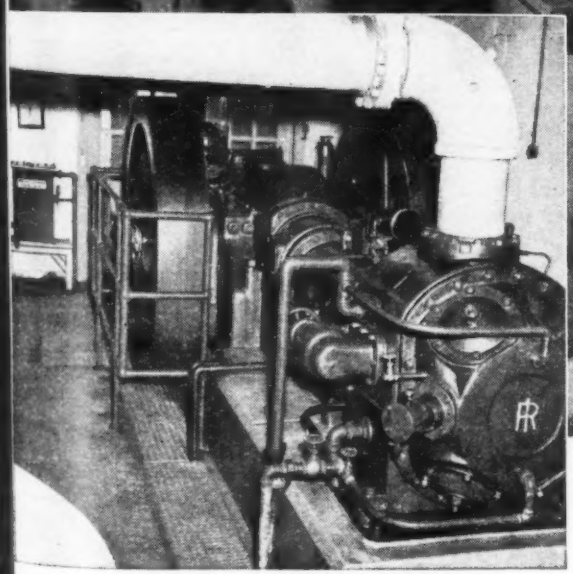
. . . NO OIL CHANGE NECESSARY

. . . OIL CONSUMPTION CUT MORE THAN 75%

. . . NO BREAKDOWNS BECAUSE OF DIRTY LUBE OIL

BRIGGS OIL CLARIFIER runs up high performance record on this Ingersoll-Rand Horizontal Oil Engine

Municipal Water Works at Findlay, Ohio, where the engineer in charge reports these amazing facts about the Briggs installation.



The Ingersoll-Rand Horizontal Oil Engine that drives an Ingersoll-Rand Air Compressor. The Briggs D-2-AX Oil Clarifier has been in service for three years. This unique installation (note pump interconnected with fly wheel) permitted installation of the Clarifier independent of the engine lubrication system.

This installation shows what Briggs Oil Clarifiers can do toward securing maximum economy and efficiency for your industrial engines . . . regardless of their size or type.

Consult the Briggs distributor nearest you and get his expert recommendations regarding the Briggs Oil Clarifier that will solve your oil filtration problem . . . give new economies in operation and longer, more efficient life for your engines.

Briggs

PIONEERS IN MODERN OIL FILTRATION

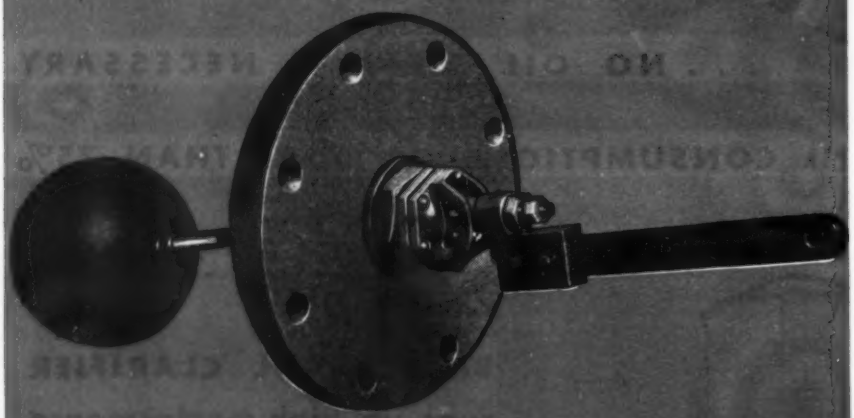
BRIGGS CLARIFIER COMPANY

GENERAL OFFICES, WASHINGTON 7, D. C.

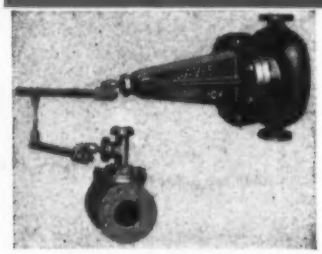
DISTRIBUTORS IN PRINCIPAL CITIES

DAVIS LIQUID LEVEL CONTROLS

with Dia-Ball packless transmission unit

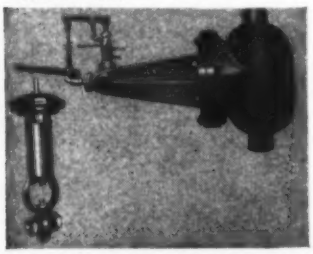


A Packless, Leakproof Transmission Unit for Liquid Level Controllers and Control Valves



No. 161D Packless Float Box and No. 66B Packless Control Valve.

No. 164D Packless Float Box with Explosion Proof Switch and No. 97SH Solenoid Valve with Explosion Proof Solenoid Case.



No. 162D Packless Float Box with Pilot Valve and No. 14 Diaphragm Motor Valve.

The Davis Dia-Ball is an improved packless transmission unit for Liquid Level Controllers and Control Valves.

- **REPLACES** conventional outboard ball bearing packing box.
- **SAVES** time and maintenance nuisance for busy engineers. No leaky shaft or stem packing with which to contend; no packing box nuts that need be taken up.
- **PROTECTS** against danger of inflammable or volatile liquids leaking and causing fire or explosion.
- **IMPROVES** control operation throughout straightlined power transmission, minimum of friction, and increased sensitivity. For pressures up to 300 p.s.i. and temperatures up to 300° F.
- **AVAILABLE** on Davis Liquid Level Controllers, Lever Operated and Solenoid values.

For complete details write for literature.

DAVIS REGULATOR COMPANY

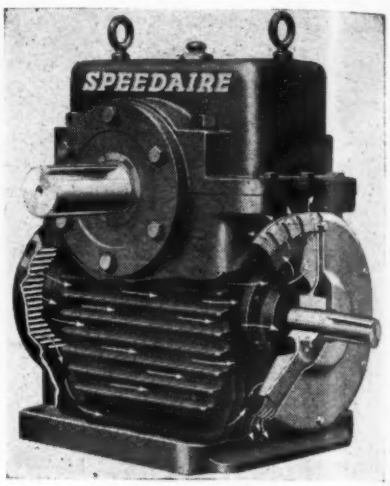
2540 S. Washtenaw Ave., Chicago, Ill.

DAVIS AUTOMATIC VALVE SPECIALTIES

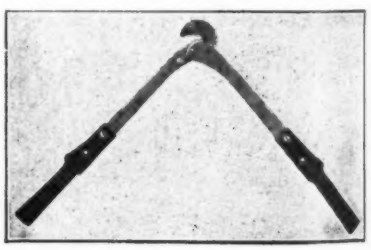
ing instruments in case depth, as well as in mounting dimensions and mounting hardware. Weight has been reduced without a reduction in accuracy. Although voltage fluctuations up to 25% may affect amplitude slightly, they are claimed to impair accuracy less than 1%. *J-B-T Instruments, Inc, 441 Chapel St, New Haven 8, Conn.*

Reduction Unit

SPEEDAIRE WORM-GEAR REDUCTION UNIT has a fan cooling system that permits reduction in size of the unit for a given hp output. New double-wall construction provides an air passage completely enveloping oil reservoir in which gear operates. Inner



housing wall forming oil reservoir is deeply finned on air side, resulting in a marked increase in heat-dissipating surface. Manufacturer claims a material reduction in dollar cost per hp transmitted. *Cleveland Worm and Gear Co, 3249 E 80th St, Cleveland 4, Ohio.*



Cutter

ALPERT LIL'GIANT CUTTER is 15 in. overall, weighs 26 oz, has a leverage range of 40 to 1 and cuts up to ¼ in. bolts or wires and ¼-in. stranded cable. An adjustable cam regulates distance between cutting edges. Cutting blades are replaceable. *Techtmann Industries, Inc, 828 N Broadway, Milwaukee, Wis.*

Silver Plating

PREPLATE PROCESS deposits silver electrolytically on aluminum or its alloys. Silver deposits of considerable thickness may go directly on aluminum surfaces, or follow a copper, nickel, zinc or cadmium deposition. Aluminum is cleaned as prescribed, passi-

What do you want to know about Turbine Oil?

Recently a number of utility plant men were asked, "What do you want to know about turbine oil?" Several of them had very specific questions. They are answered here because they may help you in selecting a turbine oil that solves, once and for all, the ever present problem of turbine oil maintenance. One question is taken up each month, but you can get the answers to all of them now—see the booklet offer.

2. What causes acidity increase in turbine oil?

Acidity in turbine oil, like asphaltene formation, is caused by oxidation—brought about by the close mixture of oil with air. The higher the temperature, the more rapid the oxidation.

Unlike the asphaltene formation, acidity is not so easily eliminated or controlled. Asphaltene-formers can be removed by refining, whereas all of the acid-forming parts of the oil cannot. Acidity formation in turbine oil is objectionable because the acids, although very weak, slowly attack certain metals forming metal soaps. Both the acids and the soaps are strong emulsifiers, so that high acidity always means a poor rate of separation from water—poor demulsibility. As the concentration of these metallic soaps increases, some of them no longer remain soluble in oil, but deposit in cooler parts of the system. These deposits are part of the sludge which forms when conventional oils are used.

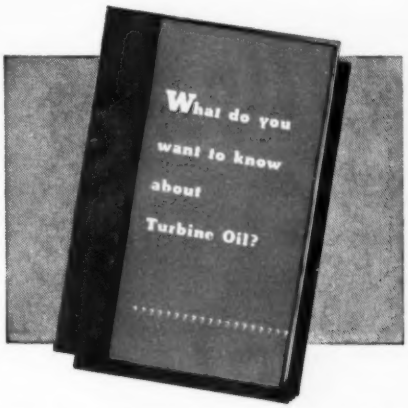
Turbine oils having acidities equivalent to about 0.3 mg.KOH/gm. tend to show only a fair rate of separation from water. When acidities approach 0.8, the emulsion test is usually poor, and many operators change oil or treat it to reduce acidity.

The problem was solved in Nonpareil Turbine Oil by removing all of the asphaltenes through refining even though this removes the natural inhibitors. An oxidation inhibitor is added that more than compensates for this loss and completely controls acidity formation. Proof of the effectiveness of this inhibitor is a written guarantee given with Nonpareil that it will not increase in acidity over the extremely low limit of 0.15 mg. KOH/gm. Operating records show that acidity seldom exceeds 0.05 in Nonpareil Turbine Oil. On top of that the same turbines are entirely free from asphaltene deposits.

It should be noted that the increase in acidity of turbine oil during operation, rather than the acidity of the new oil, is the important factor.

The function of the inhibitor used in Nonpareil Turbine Oil and how it controls acidity will be discussed in this space next month.

Gasoline Powers the Attack . . .
Don't Waste a Drop!



For all the answers send for this booklet...it contains answers to questions such as these:

1. What causes turbine oil deposits or sludge?
2. What causes acidity increase in turbine oil?
3. What is an oxidation inhibitor—how does it prevent acidity?
4. How does a guaranteed turbine oil protect the user?
5. Does the inhibitor in Nonpareil Turbine Oil wear out?
6. What causes corrosion in turbines?

Send for a copy of this booklet, or better still, ask for a Standard Lubrication Engineer. He can answer your specific questions about Nonpareil Turbine Oil. Write Standard Oil Company (Indiana), Room 1223, 910 S. Michigan Ave., Chicago 80, Ill., for a copy of the booklet, or the Engineer nearest you.

NONPAREIL TURBINE OIL

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING

LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICATION ENGINEERING • • LUBRICA

Not a minute of extra "record keeping"

MANY SYSTEMS for saving time and labor require so much clerical work and record keeping that the "cure" they offer is often worse than the "ill." This is not true of Standard's Coded Lubrication Service. Once installed, this system requires no record keeping. It automatically tells your oilers *where* lubricant is needed and *what* lubricant to use on every spot to be lubricated in your plant.

These three simple steps, described at right, show how easy it is to apply this system or adapt it to your present plan.

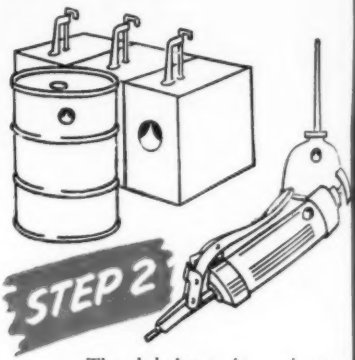
With this system installed, oiler crews simply fill their grease guns, oil cans, or other dispensing equipment with the right lubricant, by number, and apply it to the machines by number. In addition, if you feel that it is necessary to tell the oiler *how much* lubricant is needed, and *how often* to apply it, machine record cards are available on which this information can be entered. The most important problem, however, of getting the *right lubricant* in the *right place* every time is solved in the three simple steps outlined.

A Standard Oil Industrial Service Representative will be glad to show you samples of the decals and the lubrication chart. He will be glad to talk with you or your men in charge of lubrication about putting this system to work in your plant. Call the nearest Standard Oil Company (Indiana) office, or write 910 South Michigan Avenue, Chicago 80, Illinois, for a Representative. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

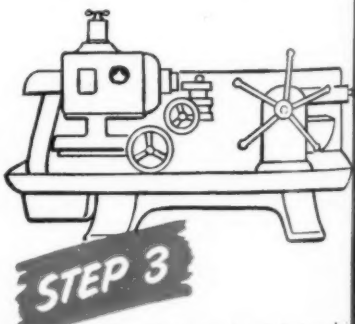
Gasoline Powers the Attack . . . Don't Waste a Drop!

How Standard Coded Lubrication Service is applied

Each lubricant used in your plant is assigned a number. These numbers are recorded on a lubrication chart—this is the only record making that is ever needed—and copies are kept in the oil room, purchasing department files, or wherever else they may be useful.



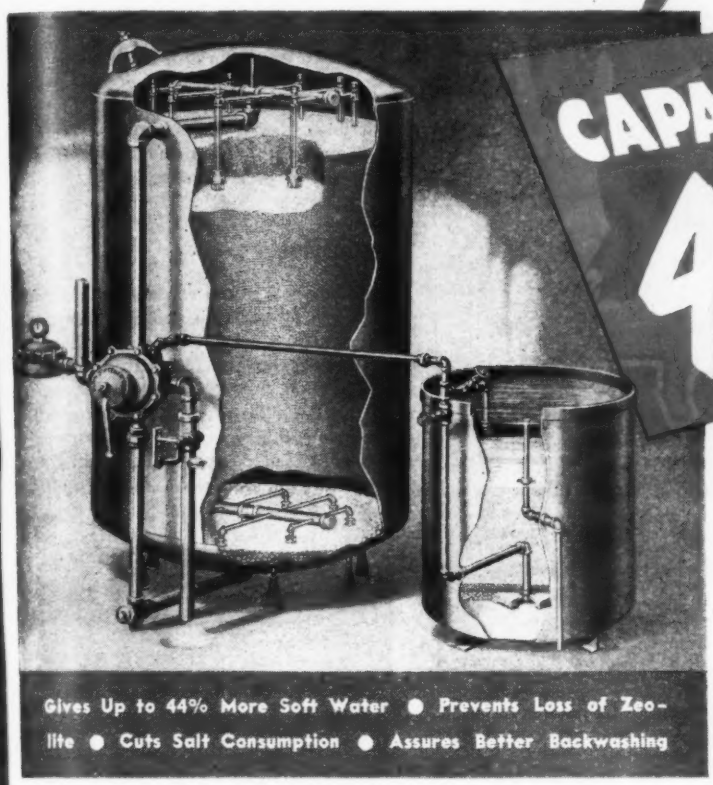
The lubricant in each storage container—barrel, drum or dispenser—is identified by the number assigned to it. Numbered decals, in two color combinations, are used for this purpose—another example of the simplicity of the system.



All points to be lubricated in your plant are also marked with a numbered decal indicating *what* lubricant is to be used, and *where* it is needed.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

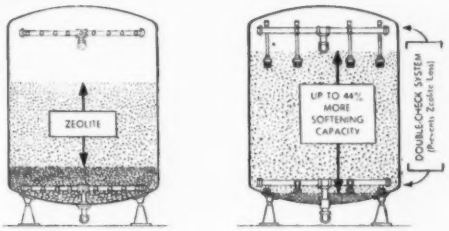
No waiting FOR POSTWAR DESIGN IN WATER SOFTENERS



CAPACITY STEPPED UP 44% IN THE NEW ELGIN

Gives Up to 44% More Soft Water ● Prevents Loss of Zeolite ● Cuts Salt Consumption ● Assures Better Backwashing

IT'S THE ZEOLITE THAT DOES THE WORK



ORDINARY WATER SOFTENER DESIGN

ELGIN WATER SOFTENER DESIGN

WILL ALSO STEP-UP CAPACITY OF YOUR PRESENT WATER SOFTENER

If your problem is simply to step-up the capacity of your present softener, the "Double-Check" manifold arrangement is the answer. It can be installed quickly to replace the conventional manifold in any make water softener. This change, along with Elgin High-Capacity Zeolite will work wonders, and the cost of the whole job is surprisingly low. Write for facts.

YES, a long list of installations prove that we have "jumped the gun" in zeolite water softener design. Every one of the Elgin "Double-Check" Softeners in service is giving the kind of performance you would ordinarily associate with "postwar development"—up to 44% more soft water than could be obtained from the conventional zeolite water softener unit of equal size.

A basic change in manifold design accounts for this remarkable increase in capacity. The Elgin "Double-Check" manifold prevents the escape of zeolite—thus permits placing a far greater amount of water softening zeolite in the softener, as shown. Naturally, this means more output of soft water; for after all, it's the zeolite that does the work.

But that's only part of the story: The "Double-Check" manifold also assures better backwashing; keeps the zeolite clean, loose and uniform; prevents the common troubles of channeling and packing of the mineral bed. As a result, brine reaches every part of the zeolite, assuring far better regeneration and therefore higher efficiency that further increases soft water output.

All this is accomplished without loss of zeolite and with lower salt consumption. Ask for the new bulletin 603, which tells the whole story of "tomorrow's water softener today".

ELGIN
ECONOMICAL WATER CONDITIONING

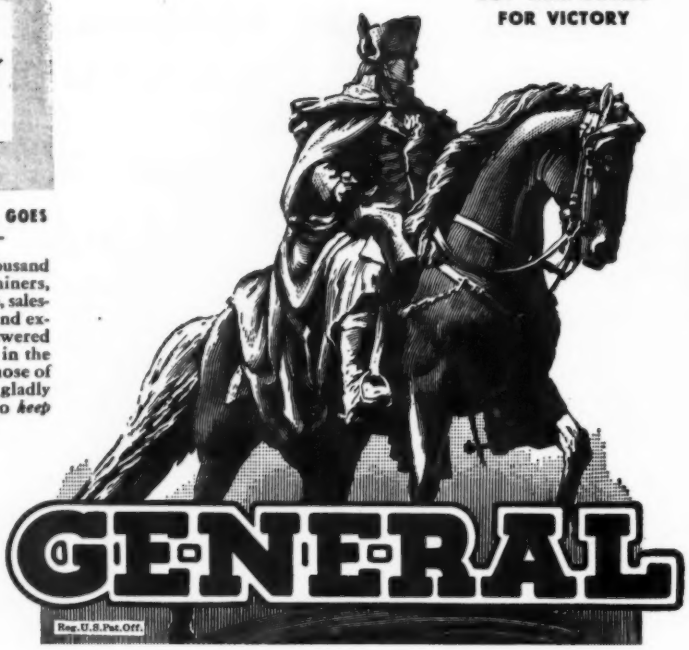
THE COMPLETE ELGIN LINE—Boiler Water Treating and Purifying Systems ● Feedwater Treatment ● Deconcentrators ● Heat Exchangers ● Water Softeners ● Filters and Purifiers ● Iron Removal Equipment ● Aerators ● Water Treating Chemicals ● Chemical Feeders ● Scale and Corrosion Inhibitors ● Sample Coolers ● Water Testing Equipment ● Zeolites

ELGIN SOFTENER CORPORATION, 130 North Grove Ave., Elgin, Illinois

GENERAL COAL GOES TO WAR—

More than a thousand of our men—miners, machinists, clerks, salesmen, engineers and executives have answered the call to serve in the armed forces. Those of us left behind gladly "Close Ranks" to *keep the coal rolling.*

BUY WAR BONDS FOR VICTORY



GENERAL

Reg. U.S. Pat. Off.

RODA — High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON — High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA — High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX STOKER — A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

COKE — Roda and Stonega from Wise County, Va., and Connellsville Coke from Pennsylvania.

CRITERION COAL — High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER — Genuine Third Vein Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

Admiralty Coal — Genuine New River Smokeless, Beckley or Sewell seam from Raleigh County, W. Va., C. & O. and Virginian Railroads.

Old Kentucky — Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

GENCO — Steam and domestic coals from a number of producing districts.

ANTHRACITE—Hazle Brook Premium . . . Raven Run

Our personnel with the experience gained through long and varied marketing activity assures proper application of one of the above brands and effective servicing of any fuel requirement.

General Coal Company

123 SOUTH BROAD STREET **PHILADELPHIA, PA.**

BRANCHES:

BLUEFIELD, W. VA. BOSTON BUFFALO CHARLESTON CHARLOTTE, N. C.
CINCINNATI DETROIT NEW YORK NORFOLK PITTSBURGH

vated, immersed in Preplate solution a few seconds, then electroplated in usual manner. *Technical processes div, Colonial Alloys Co, Philadelphia, Pa.*

Fluorescent Fixtures

ALL-STEEL UNITS include 2-40 watt, 3-40 watt and 2-100 watt models, with open-end or closed-end reflectors, in baked enamel or porcelain enamel finish. *Instant-start* design is available on 2-40 watt models. Fixtures have *Instant-Latch* feature for easy release of reflectors without tools. *Mitchell Mfg Co, 2525 Clybourn Ave, Chicago 14, Ill.*

Plastic Mat

AMERITRED IS A SOLID PLASTIC friction mat made by firmly binding friction compound together with a plastic. Mat lies flat and has a nonslip surface. Ameritred, jet black in color, comes in 29x63x$\frac{3}{64}$-in. sheets. It does not swell as rapidly as rubber when exposed to various oils. Mat can be trimmed to fit small or odd-shaped areas. *American Mat Corp, 1792 Adams St, Toledo 2, Ohio.*

Voltage Regulator

THE CR7503-D157 regulates welding current automatically, holding it constant regardless of line-voltage variations of as much as plus 10 or minus 20%. The regulator can be used on welding circuits whose power factor is from 20 to 70% and operates at 230/460/575 v on a 50/60-cycle power supply. It operates whether or not the welding current is flowing, thus compensating for a sudden voltage drop in less than three cycles, with 75% of compensation taking place during first cycle. *Industrial control div, General Electric Co, Schenectady, N. Y.*

Spout Magnets

QUICK POSITIVE-ACTING armature insures opening and closing of automatic tramp iron discharge gate. Enlarged bronze bearings on gate actuating rods are claimed to give longer life and make wearing parts easily accessible for possible repairs or replacement. Tramp iron wells provide high-intensity double-pass magnetic action on material; louver non-magnetic side plates allow ample ventilation to cool coils, but keep out injurious particles. Stearns spout magnets

Million-pound-per-hour boiler

served by 3 Byron Jackson high pressure, boiler feed pumps at Sherman Creek

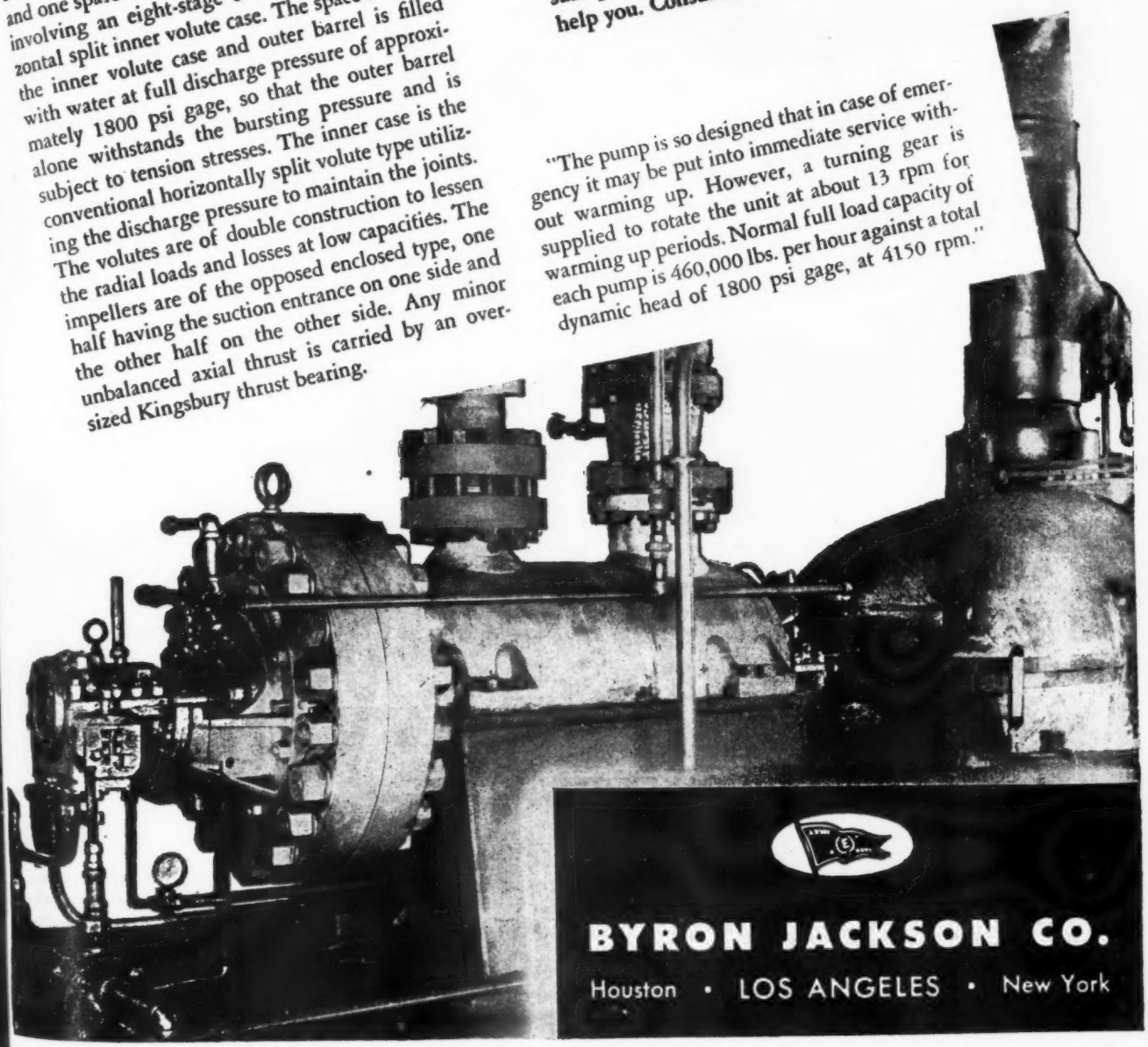
Read the description of these pumps as given in an article by Harry Knecht, Division Engineer of Consolidated Edison Company of New York, which appeared recently in Combustion Magazine.

If you are concerned with a problem of high pressure pumping, perhaps Byron Jackson engineers can help you. Consultation involves no obligation.

Harry Knecht says:

"There are three turbine-driven variable-speed boiler feed pumps—two for full load operation and one spare. They are of Byron Jackson design involving an eight-stage outer barrel and horizontal split inner volute case. The space between the inner volute case and outer barrel is filled with water at full discharge pressure of approximately 1800 psi gage, so that the outer barrel alone withstands the bursting pressure and is subject to tension stresses. The inner case is the conventional horizontally split volute type utilizing the discharge pressure to maintain the joints. The volutes are of double construction to lessen the radial loads and losses at low capacities. The impellers are of the opposed enclosed type, one half having the suction entrance on one side and the other half on the other side. Any minor unbalanced axial thrust is carried by an oversized Kingsbury thrust bearing.

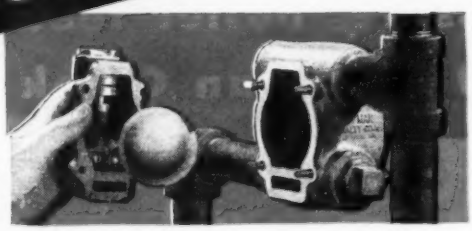
"The pump is so designed that in case of emergency it may be put into immediate service without warming up. However, a turning gear is supplied to rotate the unit at about 13 rpm for warming up periods. Normal full load capacity of each pump is 460,000 lbs. per hour against a total dynamic head of 1800 psi gage, at 4150 rpm."



BYRON JACKSON CO.

Houston • LOS ANGELES • New York

A GOOD TRAP FOR TOUGH SPOTS

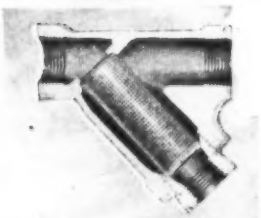


The Hoffman 50 Series Heavy Duty Trap has all working parts mounted on the cover—easy to inspect and service

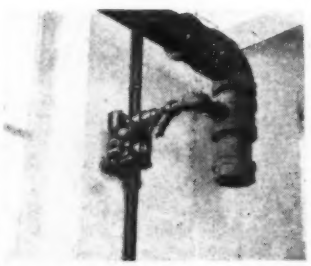
For dripping heating units or mains of large condensing capacity, the many unusual features of Hoffman 50 Series Traps will strike you right. No matter how inaccessible a spot it's in, this unit is always easy to service. Just remove the cover—*without breaking a single pipe connection*—and all working parts come out in your hand.

Take this trap apart—see the thirteen star features which have commanded the respect of practical heating men. Among them, reversible and renewable Valve Pins and Seats, renewable Thermal Unit and seamless copper float.

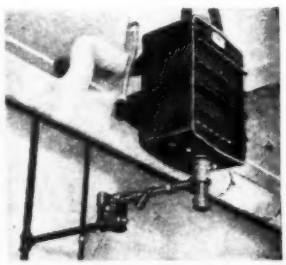
The Hoffman 50 Series Trap is available either with thermostatic bypass for air or as a mechanical-type unit. Send for bulletin giving capacities and engineering data.



Hoffman Self-Cleaning Dirt Strainers should be installed ahead of traps to protect internal working parts from excessive wear and faulty operation. Cast-iron bodies, screwed connections, brass strainer screen.



Dripping end of main



Dripping unit heater

CONSERVE WITH HOFFMAN

Fuel conservation today is more than just good business—it is a war-dictated necessity; Yet in many heating plants a needless waste of fuel is occurring because of worn-out equipment. Modernization of valves, traps and pumps is the remedy—*and your opportunity to cash in!*

When replacing equipment, protect both your reputation and your customers' best interests by using Hoffman Specialties. *Quality* has real meaning when applied to these products. They are a rare combination of better design and excellent materials, put together with genuine pride in good workmanship. Why else would you find them in so many of the finest installations. Yet with all their merits Hoffman Specialties *cost no more!*

Write for descriptive bulletins on Hoffman Valves, Traps and Pumps.

HOFFMAN

VALVES • TRAPS • PUMPS

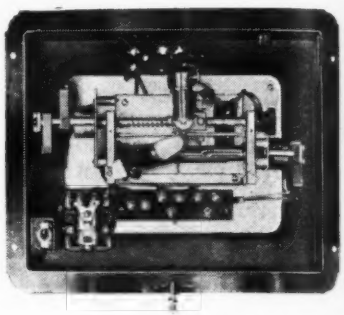
HOFFMAN SPECIALTY CO., 1001 YORK ST., DEPT. P-10, INDIANAPOLIS 7, IND.

Makers of Valves, Traps, Vacuum and Condensation Pumps, Forced Hot Water Heating Systems. Sold by leading wholesalers of Heating and Plumbing Equipment.

are in 8- to 20-in. widths in AAA series, but may be had in larger sizes for coal and other industries requiring giant models. *Stearns Magnetic Mfg Co, Milwaukee 4, Wis.*

Ellipse Maker

ELLIPTO-PIN uses the well-known string-loop method of drawing an ellipse, but eliminates the old style of sticking pins in the paper to hold string loop. Instead, special points to carry the string are supplied for attachment to an ordinary compass. Compass is held down with one hand while the other pushes pencil that draws ellipse. *Spaulding-Moss Co, 42 Franklin St, Boston 10, Mass.*

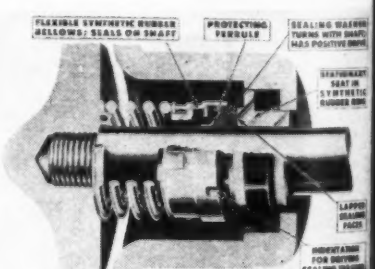


Controllers and Refinements

Imputrols control input of power, heat or flow of liquids or gases to any process equipment. Basic elements are a mercury switch mounted on a carriage, a rotating horizontal cylindrical cam, driven by a small synchronous motor, and a spiral on which the mercury-switch carriage is mounted.

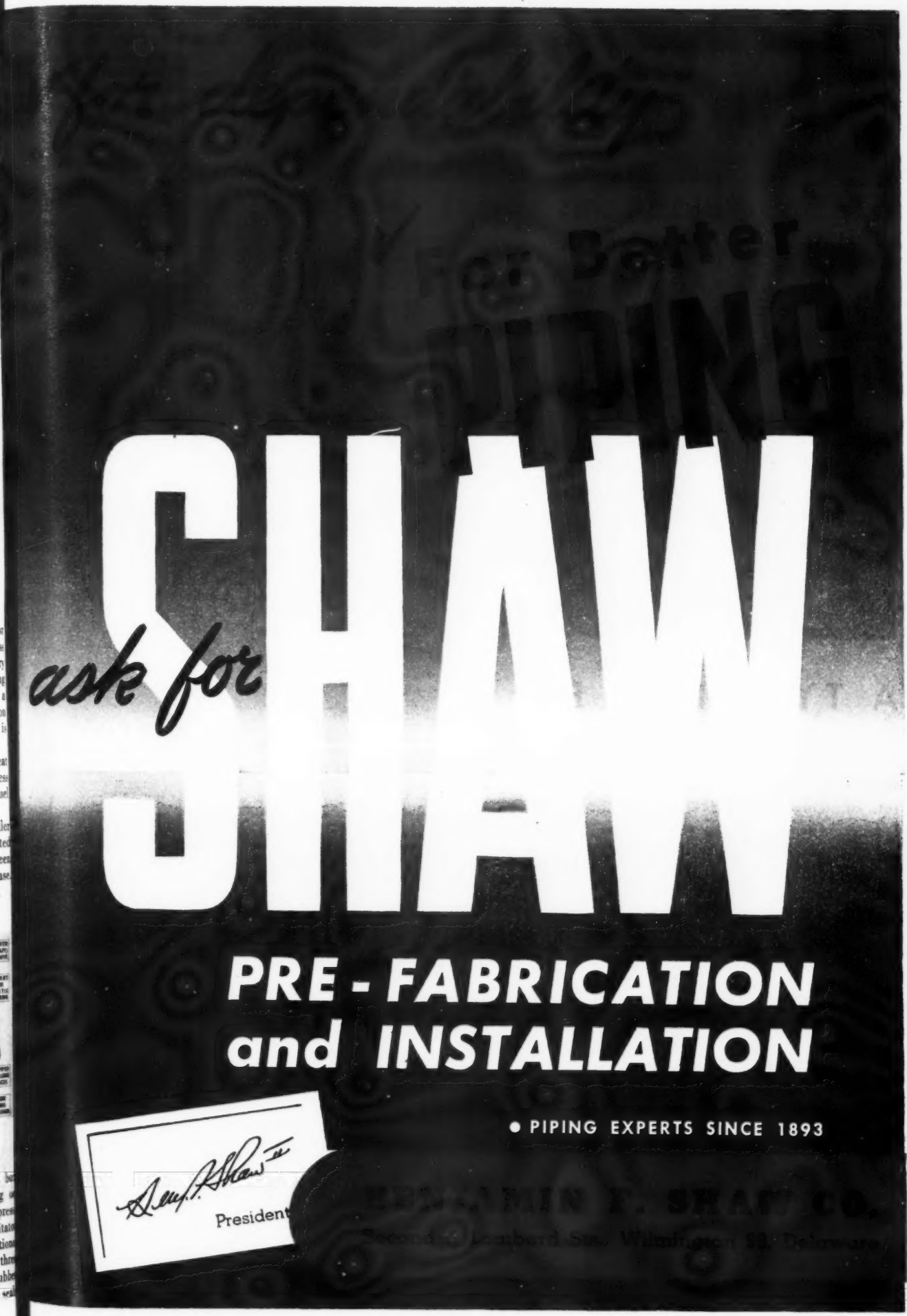
Throttltrol corrects variations in heat requirements of furnaces and process equipment by positioning a valve in fuel line.

Rheotrol, a manually operated controller for regulating input to electrically operated furnaces, ovens, heaters, kilns, etc, has been refined. It is now in a flush-mounted case. *Wheelco Instruments Co, Chicago 7, Ill.*


FLEXIBLE SYNTHETIC RUBBER BELLOWS; SEALS ON SHAFT
PROTECTING FERRULE
SEALING WASHER TURNING WITH SHAFT; HAS POSITIVE DRIVE
STATIONARY SEAT IN SYNTHETIC RUBBER RING
LAPPED SEALING FACES
IMPREGNATED FOR DRIVING SEALING WASHER

Shaft Seal

MECHANICAL SEAL eliminates stuffing box leakage and provides perfect sealing of centrifugal pumps, refrigeration compressors, speed reducers, rotary pumps, agitator shafts and other rotary sealing applications. John Crane shaft seal consists of three major parts: (1) flexible synthetic rubber bellows, tail end of which grips and seals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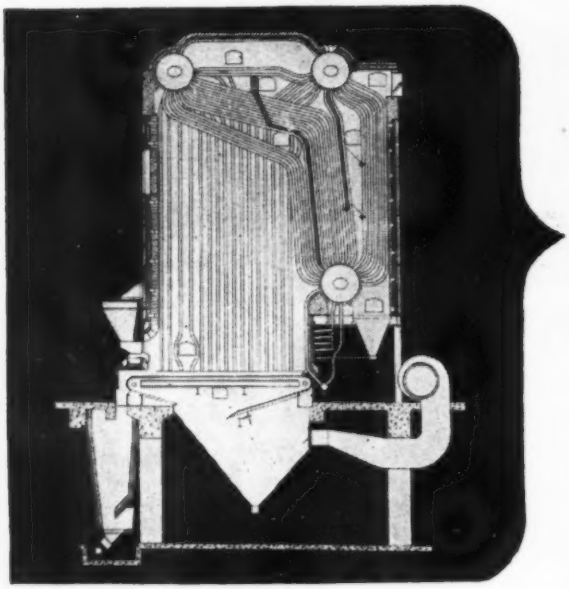


H-TYPE
RADIANT TYPE
A-TYPE
L-TYPE
4-DRUM
O-TYPE
LONG DRUM
CROSS-DRUM
UNIVERSAL STEEL-CASED
UNIVERSAL BRICK-SETTING
HORIZONTAL RETURN TUBE
LITTLE GIANT
HEATING

A TYPE BOILER

This A Type 3-drum boiler design utilizes special front bank tube curvatures to increase the radiant surface which accelerates speed of circulation and rate of steaming. This design of tube bank provides more furnace volume without increasing setting dimensions and the short high furnace is particularly suited to stoker firing because of the long vertical flame travel.

This design permits exceptionally effective side wall water cooling where operating conditions require it.

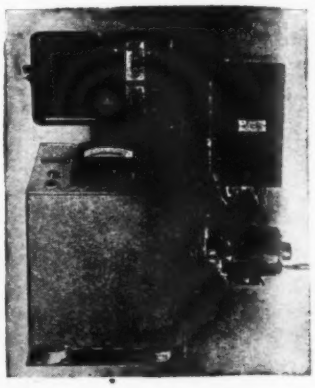
13 Basic Boiler designs and many adaptations permit Union engineers to recommend the right boiler to meet any set of conditions.

UNION IRON WORKS ★ ERIE, PA ★

BOILERS

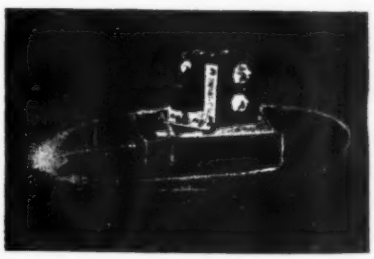
PRESSURE VESSELS • PLATE FABRICATION

along the shaft (2) a stationary floating seat, held in a synthetic rubber sealing ring (3) a positively driven sealing washer, which turns with shaft and is held against stationary seat by spring pressure. Contacting faces of washer and seat are lapped to form a leakproof seal. *Crane Packing Co,* 1811 *Cuyler Ave, Chicago* 13, *Ill.*



Crane-Stability Gage

FOR BOOM CRANES, gage safeguards equipment by continuously and accurately measuring its stability when handling loads in excess of rated capacity at a given radius, and when extending boom to an excessive radius for a given load. It not only eliminates dependence on the operator's judgment, but also permits maximum use of crane. *General Electric Co, Schenectady, N. Y.*

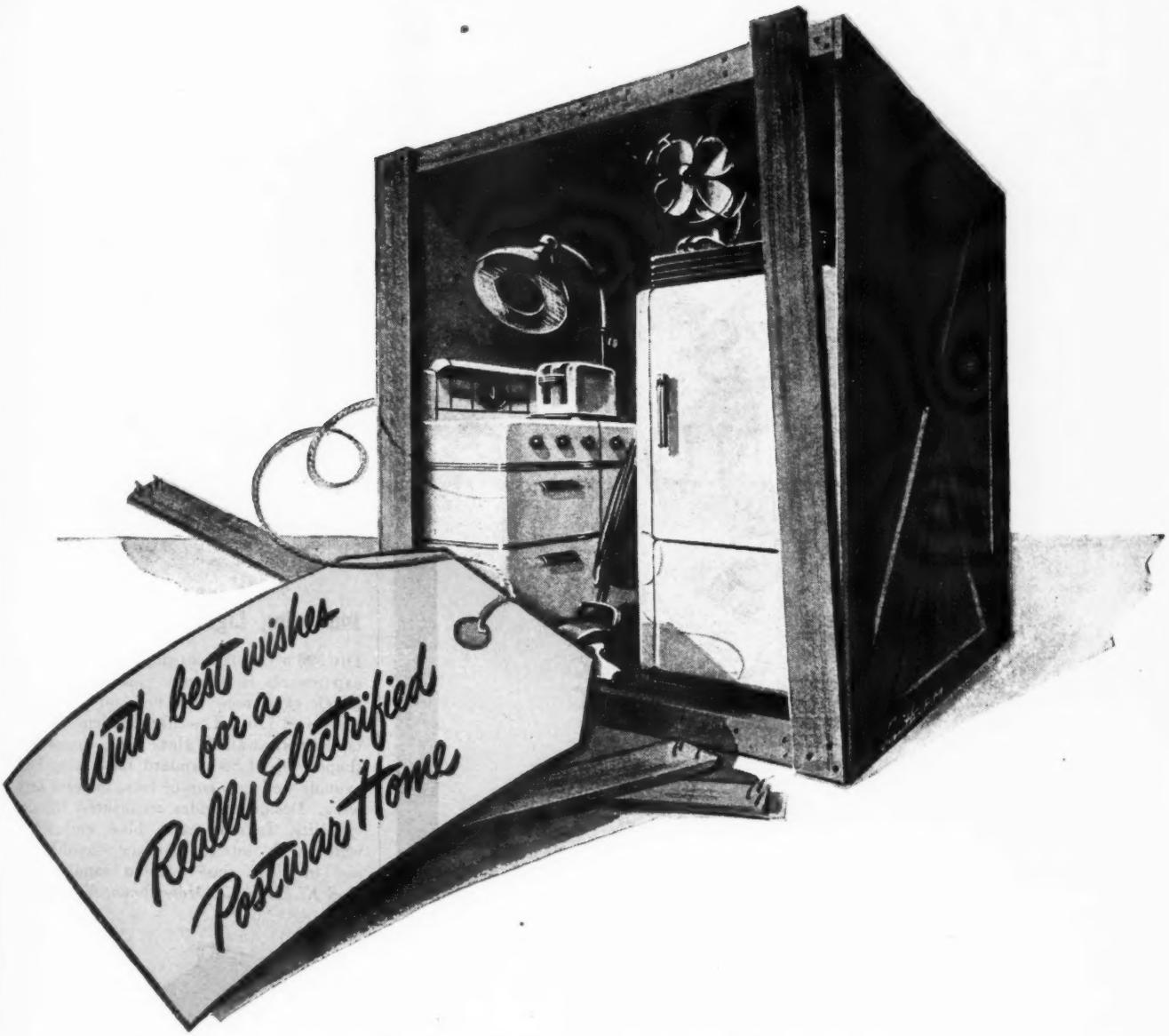


Aircraft Autotransformers

TWO SMALL-SIZED AUTOTRANSFORMERS furnish proper ac voltage for operation of 400-cycle aircraft instruments. The 6-volt-ampere unit weighs 2 oz, and 12-volt-ampere unit 3 oz. Both measure $1\frac{3}{4}$x$1\frac{1}{4}$x$1\frac{1}{16}$ in. approximately, and operate over a frequency range from 380 to 420 cycles. They can be applied on planes of a 110 to 120-v ac power source, eliminating inverters to supply correct ac voltage from dc source. Rated at 120 input, they are also for a voltage range from 110 to 130 v. *Specialty transformer div, General Electric Co, Schenectady, N. Y.*

Paint Stripper

TURCO STRIPPER L-780 loosens paint for speedy removal with water. Water-soluble paint stripper is said to be safe on wood with no tendency to cause warping. Material is claimed to be noncorrosive on metals. Apply with brush or spray and leave material on surface until it tests ready for re-



There will be no finer postwar present than a home generously equipped with electrical servants—*provided* there is sufficient electrical capacity for efficient performance.

Don't take past electrical experience as a guide. The huge increases in electrical usage in the future are certain to surprise you. Plan *reserve* capacity now and avoid costly, troublesome alterations later.

Industrial Plants! The same applies with equal weight to your electrical set-up. Why not talk it over now with your electrical contractor, utility power engineer, plant power engineer. In home or plant, planned wiring will cost a lot less than unplanned wiring. It's always wiser to Wire Ahead! 44500

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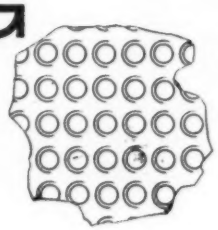
It's Always Wiser to TELEGRAM WIRE TELEGRAM AHEAD

HOW FERRISUL HERE ⇨ PREVENTS SCALE AND FOAMING HERE



TURBIDITY in your boiler feed water leads to scale on boiler tubes and turbine blades.

Color leads to foaming and priming.

But Ferrisul in your feed water system removes *both* these enemies of heat transfer efficiency *without* leaving equally dangerous scale-forming or corrosive residuals.

Ferrisul (anhydrous ferric sulfate) is useful wherever a versatile, highly efficient coagulant is required. Its floc is highly adsorptive . . . forms immediately . . . settles rapidly . . . and is effective over the entire pH range above 3.5.

Because it is a dry, free-flowing, granular material, Ferrisul is easy to handle . . . requires no expensive storage tanks . . . can be transferred on any standard conveyor system . . . and can be introduced into the system in standard dry feed machines or solution feeders. It can also be used with either hot or cold process softening.

For further details and the names of consulting water chemists prepared to prescribe and supply Ferrisul, write: MONSANTO CHEMICAL COMPANY, Merrimac Division, Everett Station, Boston 49, Massachusetts.

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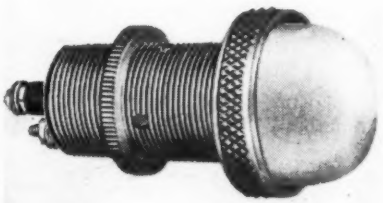
SERVING INDUSTRY...WHICH SERVES MANKIND

moval (5 to 20 min). Scrub loosened paint with a water saturated brush to form a slurry. Remove slurry by hosing with water, steam, or air and water gun. *Turco Products, Inc, 6135 S Central Ave, Los Angeles, Calif.*

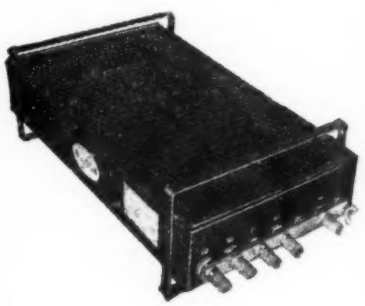
Flashlight Battery

RECHARGEABLE WET FLASHLIGHT battery is built on the principle of the automobile wet storage battery, especially valuable for operations where long-continued and steady usage is necessary. Battery requires a special Mazda lamp, which comes in 1.9 v, 0.6 amp of screw base and flange base design. *B F Goodrich Co, Akron, Ohio.*



Indicating Light

THE 590 D/E UNIT featuring a new glass lens-cap mounts in a single ¾-in. dia hole on panels of extreme thickness for heavy-duty service on 120 v. The threaded lens-cap contains heavy-walled glass lens, cupped in shape. Tip of *S6* standard 120-v lamp bulb extends well into cup of lens, for easy servicing. Design provides an insured 180 deg visibility. In red, green, blue, amber and white with interior surface sandblasted, and in clear glass without sandblasting. *H R Kirkland Co, Morristown, N. J.*



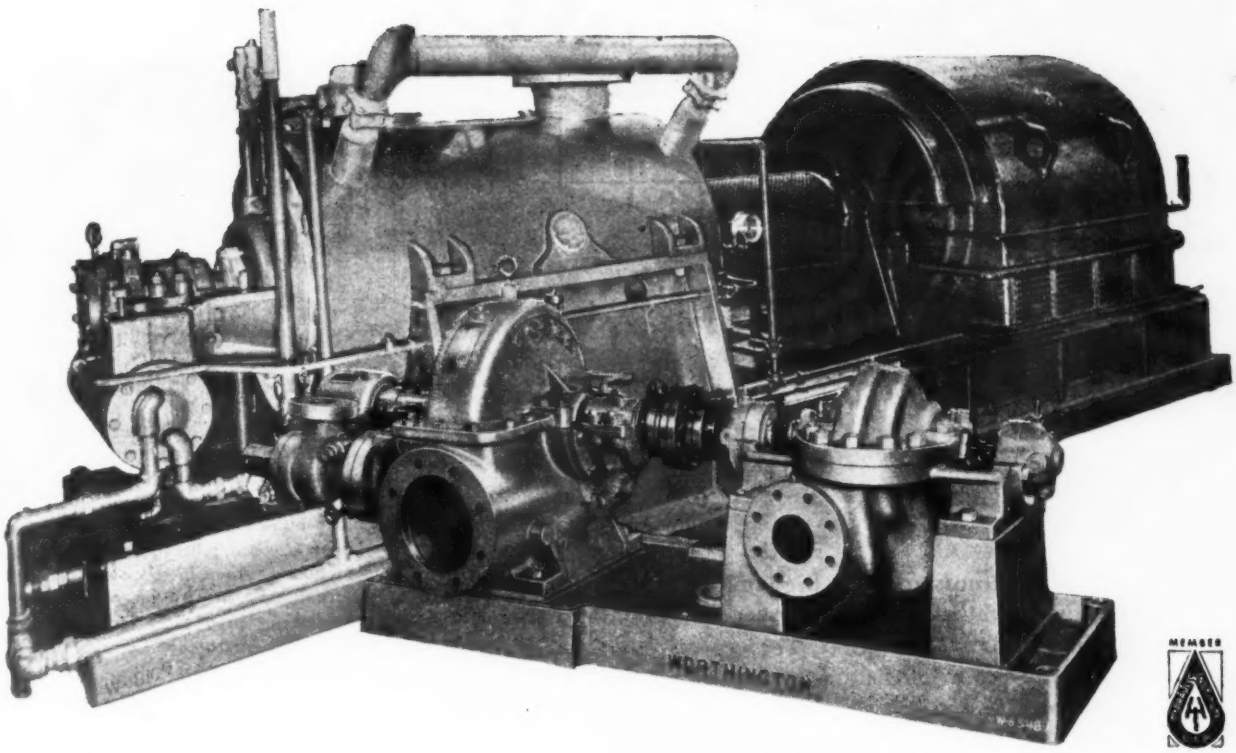
Circuit Control

WILSON TYPE 30 special tack welding circuit control panel, of simple design, is compact and sturdy. Current values are controlled by contacts and adjusted by turning fiber handles tight against a copper busbar to connect various resistors into circuit, output current being the sum of the resistors so connected. Panel is in 150- and 230-amp size. *Air Reduction, 60 E 42nd St, New York 17, N. Y.*

Graphite Lubricant

SLIPSTIK, a medium-soft wax-like graphite lubricant in solid form, is inclosed in a cylinder, 3-in. long by ¼-in. dia, with disk at each end. By pressing one disk inward, stick ejects to required length for applica-

WHAT MR. LITTLE LEARNED FROM MR. BIG



MEMBER

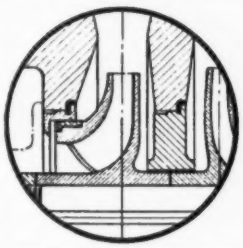
Explains Why Worthington Low Pressure Boiler Feed Pumps Give You More Value For Your Money

"Mr. Little"—the low pressure boiler feed pump—learned a lot at Worthington from high-pressure "Mr. Big".

The same pump engineering ability that built the first high pressure boiler feed pumps in the U. S. (above 1200 p.s.i.) . . . and made them able to operate 30,000 hours—and more!—without major or minor overhaul . . . built the low pressure centrifugal pump (type UB2—150 to 500 p.s.i.) illustrated above.

Investigate, in Bulletin W-318-B11B, its many advantages. Find out how *balanced design* eliminates end thrust . . . how *"elastic seal"* rings prevent interstage leakage . . . how its *rigid center support* prevents misalignment from expansion. Write us, or telephone our nearest district office. *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

WORTHINGTON'S "ELASTIC SEAL" RINGS PREVENT PUMP TROUBLES BEFORE THEY START



Interstage leakage (a common cause of pump breakdowns) is definitely ended with Worthington's exclusive "Elastic Seal" Rings on the job.

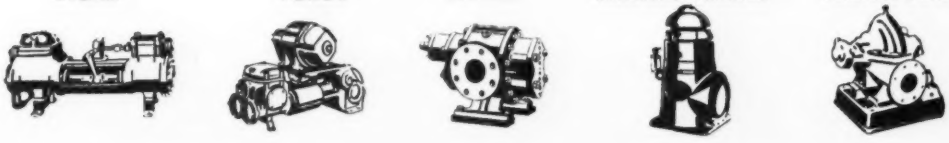
Other low-maintenance construction features: accessible, horizontally-split casing . . . both stuffing boxes under minimum pressure...simple rotor construction...no diffusion vanes.

WORTHINGTON *BEHIND THE NAME* WORTHINGTON

CP4-19

WORLD'S LARGEST MANUFACTURER OF PUMPS

STEAM POWER ROTARY VERTICAL TURBINE CENTRIFUGAL



Keep Your POWER CURVE UP with DIXON Graphite "Know-How"

It's up to today's lubricants to do a bigger job than ever—to prolong the life of essential machines . . . to keep overburdened, hard-to-replace equipment turning out vital work.

Repeatedly, where plain lubricating grease or oil does not function satisfactorily, Dixon's Graphite excels as a lubricating additive. It prevents overheating . . . wear and cutting in presence of extreme pressure, speed, temperature and variations of moisture. Used also as pipe joint coating, conductor of heat and electricity, releasing agent, pigment for resisting heat, cold and corrosion in protective and refractory coatings.

THE KNOW-HOW PACKAGE IS NOW USED FOR THE FOLLOWING GRAPHITES:

1 and 5 pound containers Ticonderoga No. 1 (Large Flakes)
1 and 5 pound containers Ticonderoga No. 2 (Medium Flakes)
1 and 5 pound containers No. 635 (Finely Powdered Flakes)
½, 1 and 5 pound containers Microfyne (Extra Finely Powdered Flakes)
Round all-cardboard containers will replace all-metal containers when stock is exhausted.

In order that plant engineers using Dixon's Graphites may get the most out of their machinery, "KNOW-HOW" containers are designed to give full information of its application in the field. Dixon's "KNOW-HOW" containers are illustrated with use-pictures, shop applications, plus a 7-page illustrated booklet attached to package.

For every job, there's a Dixon Graphite.

★ *At your supply house.*

JOSEPH DIXON CRUCIBLE COMPANY, JERSEY CITY 3, N. J.

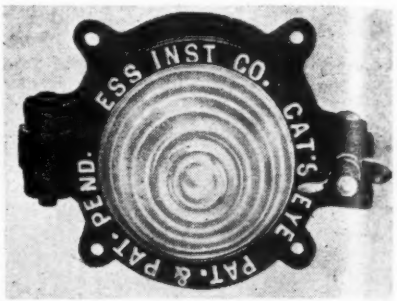
Canada: Canadian Asbestos Company • Montreal • Toronto • Vancouver • Winnipeg

Pipe Joint Compound • Graphite Seal • Graphited Oils • Cup and Pressure Gun Grease • Welding Rods

Gear Lubricants • Waterproof Graphited Grease • Graph-Air Guns • Auto-Marine Grease • SlipStik

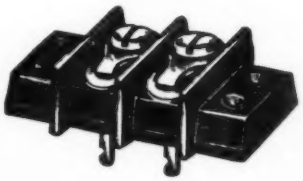
Industrial Oven Lubricant • Lathe Center Graphite Lubricant • Belt Dressing (Contains no Graphite)

tion. After using, place other disk on top of exposed stick and push inward. Lubricant adheres to metal, wood, fiber, leather or other materials. *Joseph Dixon Crucible Co, Jersey City 3, N. J.*



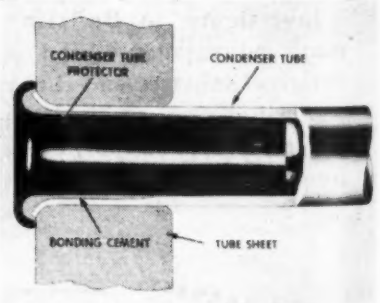
Firebox Flame Indicator

CAT'S EYES are attached to burners or peepholes to enable furnace and boiler room operators to see flame characteristics in firebox. Eye center shows flame in its natural color; outer frosted portion is a sensitive shadow-screen, reflecting any change in combustion. Made in three models: *A* with external lugs, *B* with internal lugs and *C* threaded for pipe extensions, all identical in size. *Ess Instrument Co, Fort Lee, N. J.*



Terminal Strip

BRASS TIN-PLATED Y terminal mounts on 140, 141 and 142 series barrier strips and permits a screw connection above and a solder connection below panel. Terminal mounts securely in block and is also held by screw so that connecting wire comes in direct contact with terminal. Bakelite body is of BM 120 compound, according to Navy Specifications 17P4. Barriers separating terminals are of sufficient height to give desired creepage distance and prevent shorts from frayed wires. *Howard B Jones Co, 2460 W George St, Chicago 18, Ill.*



Condenser-Tube Protectors

CONDENSER-TUBE INLET ENDS protect against destructive effects of air erosion and sand abrasion. Protectors are unaffected by temperatures to 275 F, and resistant to air im-

Piping IS OUR BUSINESS!

When you need materials for any piping requirement, remember that dependable Grinnell piping products are available nearby. Grinnell maintains completely stocked warehouses in principal cities. From these warehouses or from your local Grinnell jobber you can get anything you need.

You can also get experienced advice from Grinnell Engineers on any unusual piping problem.

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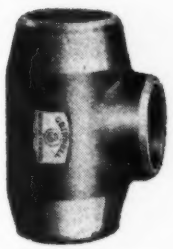

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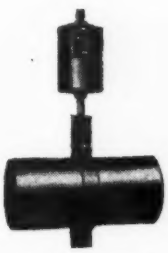

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with Dependable ADECO

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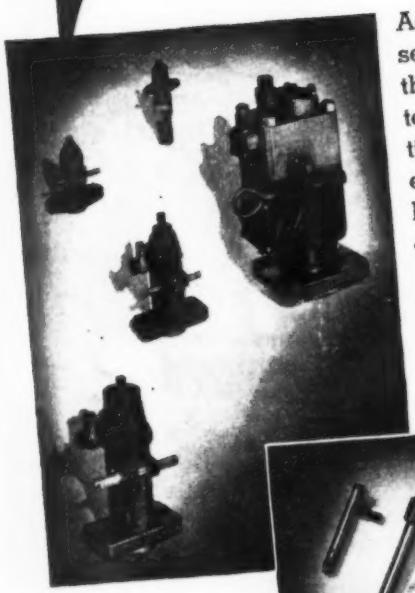
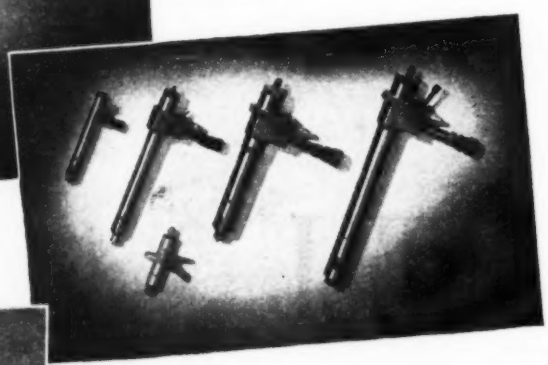


Adeco equipment is engineered to secure the optimum performance of the engine you are building or plan to build. Today's line of fuel injection pumps, nozzles and nozzle holders is the most dependable in Adeco history—the result of years of pioneering and research for the diesel industry. Their performance speaks louder than words in pointing the way to the finest in diesel fuel injection equipment.



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America's most widely used Nozzle Tester enables any mechanic to make quick, accurate tests on injector opening pressure, spray pattern, etc., and detect stuck needle valves and leakage around valve seats. Compact, portable, sturdy, precision-built. Pressures up to 10,000 p.s.i. Tests both large and small injectors. Avoids costly delays and possible damage to engine. Also obtainable with Navy-approved gauge. Write for bulletin.

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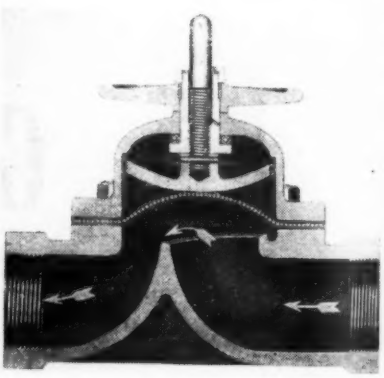
pingement and contaminated salt or fresh circulating water. Manufacturer claims they prolong tube life, save essential materials and prevent *outages* at critical moments. Various sizes for marine and stationary power-plant condenser tubes. ***Crane** Packing Co, 1811 Cuyler Ave, Chicago 13, Ill.*

Outdoor AC Welders

NEW 500-AMP WELDER has a current range from 100 to 625 amp; 300-amp welder, from 60 to 375 amp. Both are designed for shipyards and similar locations exposed to weather. *Idlematic* control functions to reduce output voltage automatically to less than 30 v whenever arc is not in operation. *General Electric Co, Schenectady, N. Y.*

Diaphragm Valve

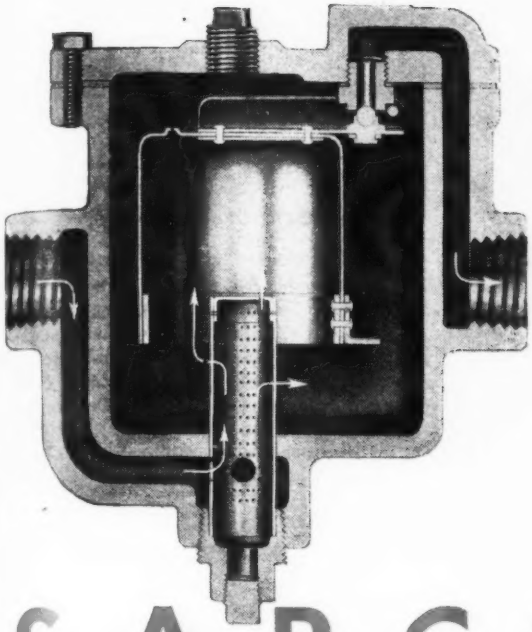
NO. 1455 VALVE requires no repacking, no reseating; it has no stuffing box and all moving parts are fully protected from fluids handled. Diaphragm valve may be installed in horizontal or vertical positions, below or



above ground, and with handwheel in any position, without danger of leaks. For on-or-off service where a tight shutoff is desired, valve may be used for throttling service within certain limitations. Diaphragm may be replaced without removing valve from line. *McAlear Mfg Co, 1913 S Western Ave., Chicago 8, Ill.*

Shielded-Arc Electrode

FLEETWELD 35, general-purpose electrode for mild steel, is specifically for ac operation. It also operates on dc with either polarity, depending on work being done. Available in $\frac{1}{8}$- $\frac{5}{32}$- and $\frac{1}{16}$-in. sizes, elec-



SARCO

BUCKET STEAM TRAPS

Everywhere

On heavy heat using equipment such as presses, vulcanizers and supply lines that have very heavy loads one minute—and little or none the next, this trap is preferred.

It can be piped "straight-thru"; all mechanism is integral with the cover and is protected by a Sarco strainer *inside* the trap. It is made in standard sizes for pressures up to 250 lbs. and in forged steel types up to 900 lbs. Ask for Catalog No. 350.

BUT ONE TRAP IS NOT ENOUGH

Each of the different types of Sarco traps has a separate function. They are not interchangeable.

All save steam. The Sarco man near you knows all types and can fit the right trap to your job. His unbiased advice is yours for the asking.

Why not ask the man who knows all types and their application when you change over—the Sarco representative near you?

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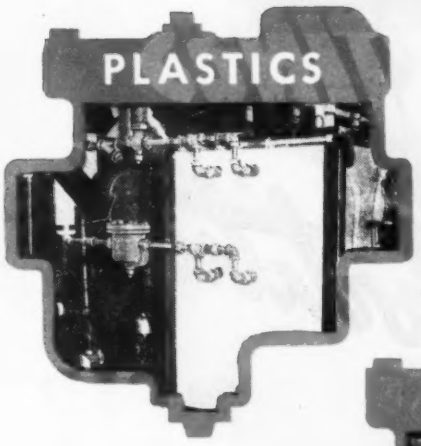
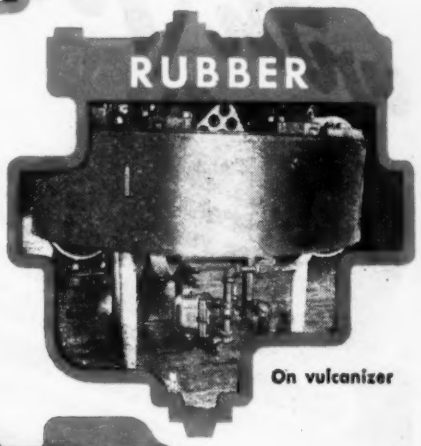
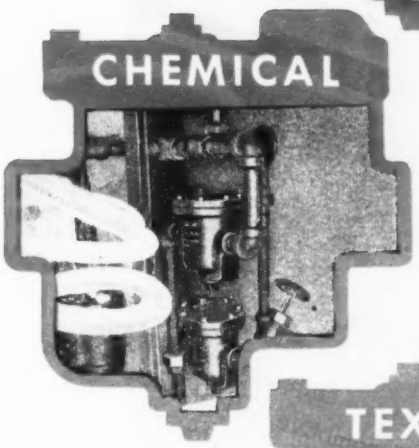


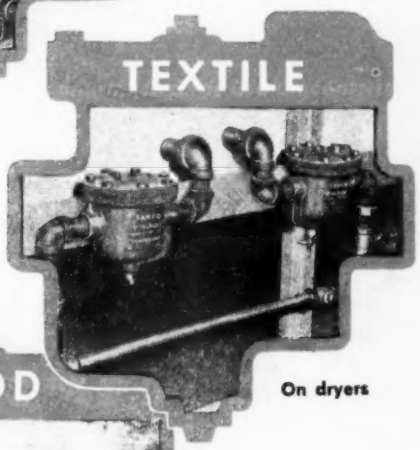
In plastics and plating plant



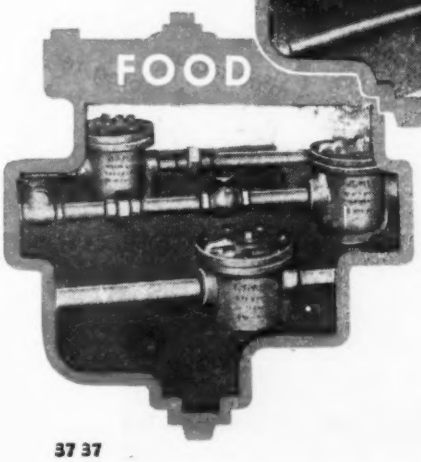
On vulcanizer



On condenser coils



On dryers



On smoke house coils

37 37

INTESTINES with Fortitude!

PTP

Seamless steel tubes are the intestines of the ship, the power plant, the oil refinery, the locomotive, and the chemical plant...delivering an ever-flowing flood of power to America's mighty production efforts.

Seamless steel tube "know-how" is vitally necessary to keep those lines going steadily. Cold drawn seamless steel PTP tubing achieves accuracy to size and uniformity of gauge through exacting control and thorough inspection at every step in manufacture. Where cost is a factor, and seamless steel tubing required, PTP tubing offers an economical and satisfactory solution to the problem.

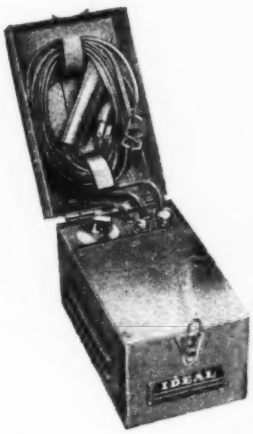
★ Official United States Navy photograph. 440 series destroyer; a component part of the great American Fleet, largest in the history of the world.

PIPE & TUBE PRODUCTS
INCORPORATED
Manufacturers of Cold Drawn Seamless Steel Tubing
JERSEY CITY, N. J. • WORKS: READING, PA.

trode is for high-speed welding of single or multiple passes for work in flat, vertical or overhead positions. Fleetweld 35, packed in 50-lb. containers, is in standard 14-in. lengths. *Lincoln Electric Co, Cleveland, Ohio.*

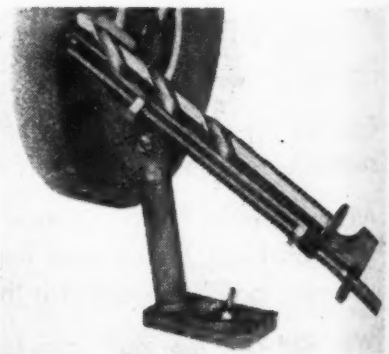
Six Element Oscillograph

UNIT IS SAID TO BE SMALLEST six-element oscillograph. Apparatus can record simultaneously six different measurements. Each of the six circuits to be measured enters at the right where their characteristics are translated into six different light beams. Each beam registers as a thin line on photographic paper rolled up at left, forming a permanent, composite record. *General Electric Co, Schenectady, N. Y.*



Metal Etcher

TOOL ROOM ETCHER burns into surface of iron, steel or its alloys, making a smooth, permanent mark. Depth of mark is controlled by etching heat and speed of writing. Four etching heats are 120, 240, 420 and 700 watts. Available in 4- and 2-oz sizes, all parts tuck inside cover for carrying. *Ideal Commutator Dresser Co, Sycamore, Ill.*



Drill Sharpener

SUPER JIG, mounted next to a grinding wheel, handles drills from $\frac{3}{32}$- to $1\frac{1}{16}$-in. dia. and up to 11 in. in length. Jig adjusts to either 59, 69 or 88 deg angles. *Super* is claimed to grind a drill to factory finish in 25 sec. *A D McBurney, 939 W 6th St, Los Angeles 14, Calif.*

Light, Fluffy, Resilient and Greaseless... Yet It Packs to Extreme Density!

THE ANCHOR PACKING CO. TRADE MARK

CARBONITE PACKING

arbonite Packing in coil form! It's easy to use... rings re easily cut... and it's unique in that it contains no il, grease, wax or tar.

ıgredients used—asbestos and graphite—will with- and the highest temperatures of any organic or mineral ubstances... can be used in temperatures as high as 50° F. Each fiber is treated with a dry binder, making e packing soft, fluffy and perfectly dry.

Carbonite Packing is recommended for use on centrifugal pump shafts, high or low speed; rotary rods or shafts; reciprocating rods and plungers; expansion joints; valve stems; and numerous other uses against air, oil or water.

There are many advantages in using Carbonite Packing. Write today for these details.

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ton 2, Texas	509 Washington Avenue
as City 6, Missouri	1332 Oak Street
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These NEW Catalogs, Booklets and Bulletins Are Yours for the Asking!

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

1 **AIR-CONDITIONING EQUIPMENT**—Carrier Corp, S Geddes St, Syracuse, N. Y. 8-page catalog discusses air-conditioning, refrigeration, heating and related equipment.

2 **REFRIGERANT CONDENSERS**—Air conditioning and refrigeration div, Worthington Pump & Machinery Corp, Harrison, N. J. 6-page bulletin No. C-1100-B16 describes Worthington refrigerent condenser line and includes closed horizontal shell-and-tube design with plain or finned tubes and fixed tube sheets, closed horizontal shell-and-tube type with removable tube bundles, vertical Spira-flo shell-and-tube design and shower (evaporative) type.

3 **CHILLING MACHINES AND EXCHANGERS** — Air conditioning and refrigeration div, Worthington Pump & Machinery Corp, Harrison, N. J. 10-page bulletin No. C-1100-B15 shows the general arrangement of Worthington scraped-surface double-pipe chilling machines and exchangers.

4 **AMMONIA DISTILLERS** — Frick Co, Waynesboro, Pa. 1-page bulletin No. 334-A gives description and operation instructions for Frick ammonia distillers. One side of sheet gives detailed diagram and photograph of equipment.

HOW TO ORDER

Be sure to fill out, completely, one coupon for each piece of literature you order. (See sample below.) This gives your request authority and helps the manufacturer to address your copy completely. Readers who fail to prepare request blanks correctly may be disappointed under difficult postal conditions and limited quantities of bulletins available today.

Use as many coupons as you need, but cut them out and send them as one block in an envelope addressed to POWER, 330 W 42nd St, New York 18, N. Y.

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BOILERS AND AUXILIARIES

5 **PNEUMATIC EJECTOR** — Yeomans Bros Co, 1433 N Dayton St, Chicago 22, Ill. 8-page bulletin No. 4500 on the Transporter pneumatic ejector describes what it is, where it can be used, how it operates, industrial application, and size and capacity.

6 **FIREBOX FLAME INDICATOR**—Ess Instrument Co, Fort Lee, N. J. 4-page bulletin No. 441 describes Cat's Eye firebox flame indicator, a device which enables furnace and boiler room operators to see flame characteristics in firebox.

7 **FIRE SCALE AND FLAME ERADICATOR**—G N Coughlan Co, W Orange, N. J. 4-page booklet contains informative data on Chimney Sweep, a combination of chemicals which reduce by chemical action residual deposits of combustion found in boilers.

8 **DUST COLLECTOR** — Aerotec Co, Thermix Engrg Co, Greenwich, Conn. 4-page booklet discusses history, development, capacity and application of the Aerotec tube.

MECHANICAL TRANSMISSION

9 **VARIABLE SPEED TRANSMISSION** —American Pulley Co, 4200 Wissahickon Ave, Philadelphia 29, Pa. 4-page bulletin No. SJ-44 points out features of Speed-Jack drives and provides specifications and installation data.

10 **MOTOR PULLEYS**—American Pulley Co, 4200 Wissahickon Ave, Philadelphia 29, Pa. 8-page catalog No. HT-44 contains dimensions and list prices of standard sizes and prices for made-to-order pulleys.

11 **FLAT-BELT DRIVE EQUIPMENT** —American Pulley Co, 4200 Wissahickon Ave, Philadelphia 29, Pa. 24-page catalog No. FBD-44 gives information on steel split pulleys and bushings, shaft collars, shaft hangers and bearings, split and solid conveyor pulleys, motor pulleys, belting and Econ-o-matic for short-center flat-belt drives.

12 **V-BELT DRIVE EQUIPMENT** — Allis-Chalmers Mfg Co, Milwaukee 1, Wis. Bulletin No. B6331 reviews company's line of V-belts, sheaves and drives.

13 **SPEED REDUCERS** — Philadelphia Gear Works, Inc, Erie Ave & G St, Philadelphia 34, Pa. 12-page bulletin No. 250 discusses design features, ratings, limitations, capacities and dimensions of AirKooled worm-gear speed reducers.

PIPING, FITTINGS, VALVES AND SPECIALTIES

14 **FLEXIBLE METALLIC INTERLOCKED HOSE** — Pennsylvania Flexible Metallic Tubing Co, 72nd and Powers Lane, Philadelphia 43, Pa. 12-page bulletin discusses Penflex galvanized steel hose and bronze steam hose with couplings.

15 **SAFETY VALVES**—Manning, Maxwell & Moore, Inc, Bridgeport 2, Conn. Consolidated safety valve and safety relief valve catalog contains capacity tables, sizing charts and other engineering data important to valve users.

16 **VALVES AND CYLINDERS**—Galland-Henning Mfg Co, Milwaukee 7, Wis. 6-page bulletin No. 87 describes Nopak valves and cylinders.

17 **WROUGHT-IRON CONDUIT**—A M Byers Co, Pittsburgh, Pa. Single-page reprint gives applications of Byers' wrought-iron conduit.

18 **VALVE-POSITIONING DEVICE** — Wheelco Instruments Co, Harrison and Peoria St, Chicago 7, Ill. 4-page bulletin No. J602-2 describes the new Throttitrol, a simplified valve-positioning device used with any control instrument having a high and low contact with a neutral position.

WELDING

19 **WELDING SYMBOLS CHART** — Hobart Bros Co, Hobart Sq, Troy 1, Ohio. Wall chart illustrates the use of welding symbols recommended as American Standard by American Welding Society.

20 **ARC WELDING** — Lincoln Electric Co, Cleveland 1, Ohio. 48-page booklet No. 440 describes Fleet-Welding method of increasing speed of welding mild steel. Manual assists users of arc welding in establishing proper welding procedure and procedure control.

(*Continued on page* 174)

FILL OUT AND SEND TODAY! NOT GOOD AFTER DECEMBER 1, 1944.

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POWER, 330 West 42nd St., New York

$12,000 failure in a $12 breaker

Could it just as well have been one of yours?

A motor-circuit fault occurred in a busy war-production plant, and the undersized circuit breaker went up in a burst of blue flame. Then, in an instant, the inadequate main circuit breakers failed as well—with a further dangerous blow-up that sent hot metal flying. Not until the power company's breaker tripped out was the short-circuit current brought to a halt. Production of the entire plant was crippled until repairs could be made. The loss exceeded $12,000.

A failure like this—with its threat to production and danger to personnel—strikes more frequently than you think. It could occur tomorrow morning in hundreds of plants where electric circuits are being called upon to handle increased loads that they were never designed to carry. In such "shoestring" power distribution systems, fuses and breakers often lack the capacity to interrupt the full rush of short-circuit current that can flow from the present source.

One **new circuit breaker is no remedy. The interrupting capacity of *every* protective device, from entrance cable to machine, must be brought into line.**

GENERAL ELECTRIC

TO BE SURE **of adequate interrupting capacity all through the plant, start making plans now to convert to a G-E load-center distribution system.**

HOW A LOAD-

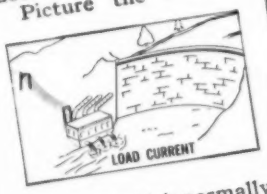
keeps short-circuit

NEED FOR ADEQUATE IC* OFTEN OVERLOOKED

CAPACITY OF SUPPLY SOURCE "TAKES OVER" WHEN SHORT CIRCUIT OCCURS

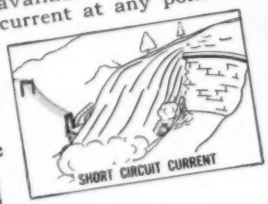
When a short circuit occurs, the flow of current is not limited by the size of the load—it may increase to several hundred times the load current. Thus the load *carrying* capacity of breakers or fuses is no measure of their adequacy as protective devices.

Picture the collapse of a dam which normally supplies a penstock. The resultant damage is limited, not by the capacity of the penstock, but by the head and capacity of the reservoir. So it is with circuit-breaking equipment. Like the rush of water down the valley, too, the damage may be cumulative, so that normally adequate structures below are breached and broken one by one. Failure of an inadequate circuit-interrupting device may cause a new, more serious short within the device itself as parts are welded under the intense heat.



CALCULATING SHORT-CIRCUIT CURRENT

Accurate methods now exist for calculating the available short-circuit current at any point in a power system. These are applied *in advance* in specifying the coordinated elements that go together to make up a G-E load-center distribution system. A G-E application engineer can make sure that any special conditions within your plant are taken into account.



LOAD GROWTH A FACTOR

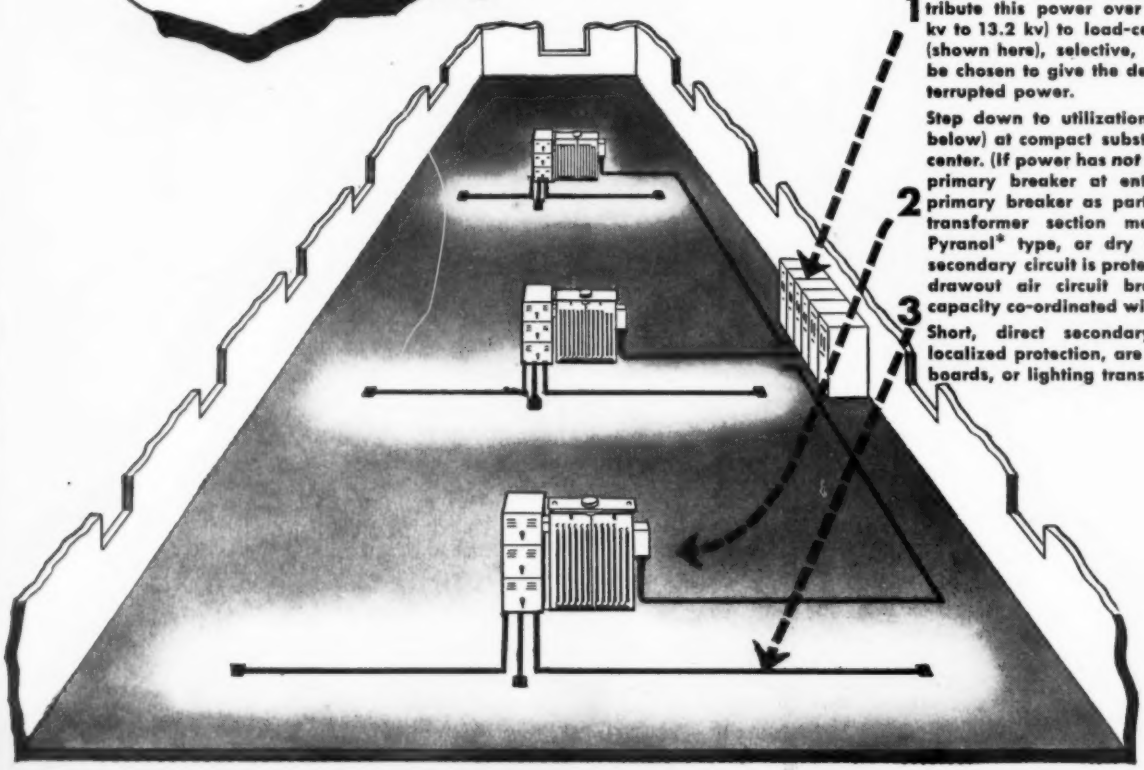
Systems which have been operating for years without a major short circuit often become increasingly vulnerable as load growth raises the capacity of the supply source, and as equipment weakens with age.

*Interrupting Capacity

G-E LOAD-CENTER power distribution affords protection from the dangerous, production-crippling "blow ups" that can result from devices of inadequate interrupting capacity. What's more, the circuit protection for each load area *stays* adequate, despite expansion of your electric system to serve new areas—provided, of course, the system was properly planned originally. Each load-center substation is an individual "road-block" which isolates such short circuits as may occur. Additions to the co-ordinated system can be made without concern as to the interrupting capacity of devices in the localized secondary circuits (where transformers are not in parallel on the secondary side).

War plants equipped with load-center systems have established exceptional records for *uninterrupted* power usage. Now, they are finding that the flexibility of their systems to meet plant changeovers is an equally great advantage.

Before you install any new switchgear, or attempt to revamp outmoded power distribution circuits, switchboards, or substations—better investigate the performance records of G-E load-center installations. Just ask your local G-E representative.



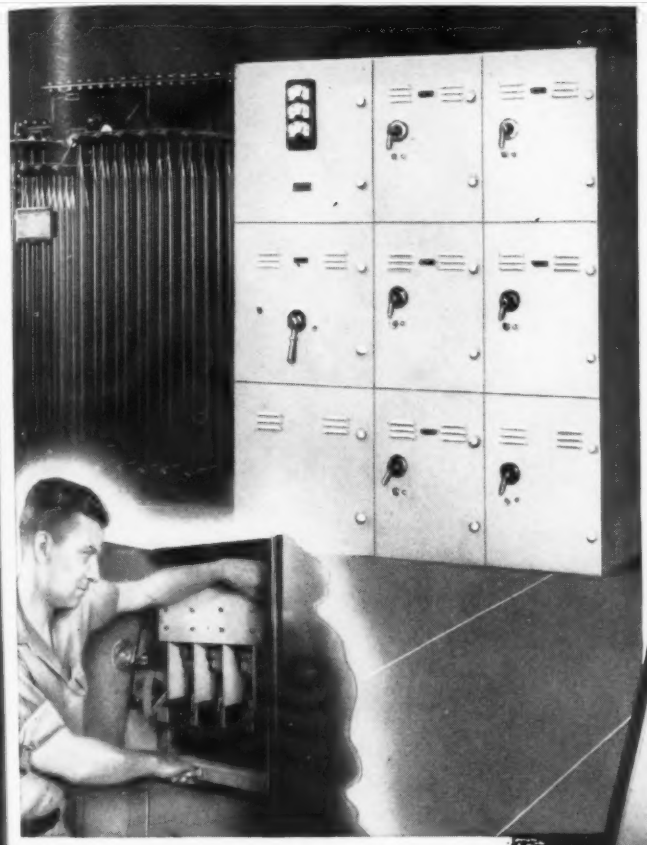
1 Bring in your high-voltage power through a metal-clad distribution and metering panel (or master unit substation if power is purchased at 13.2 kv or above). From primary breakers, distribute this power over high-voltage lines (2.3 kv to 13.2 kv) to load-center substations. Radial (shown here), selective, or network systems can be chosen to give the desired assurance of uninterrupted power.

2 Step down to utilization voltage (600 volts or below) at compact substations right at the load center. (If power has *not* come through metal-clad primary breaker at entrance panel, include a primary breaker as part of the substation.) The transformer section may be noninflammable Pyranol* type, or dry type if preferred. Each secondary circuit is protected by a metal-enclosed drawout air circuit breaker, with interrupting capacity co-ordinated with the transformer rating.

3 Short, direct secondary feeders, each with localized protection, are run to equipment, panel boards, or lighting transformers.

*Reg. U.S. Pat. Off.

CENTER POWER SYSTEM
currents from *RUNNING WILD*



Key points in load-center power protection are the G-E air circuit breakers, which localize faults in the low-voltage feeder circuits. Their interrupting capacities are *always* matched to the capacity of the transformer.

The draw-out feature simplifies inspection. Interchangeability of breakers cuts circuit-outage time for servicing. Safety interlocks automatically open the breaker upon any attempt to insert or withdraw the breaker while it is in the closed position.

Short-circuit protection of primary plant circuits is best assured by metal-clad switchgear, with magne-blast air circuit breakers, located at the load-center substation, at a central distributing point, or as part of a master unit substation.

Breakers, buses, and other circuit components are completely enclosed within grounded steel compartments that go together to form fully co-ordinated, factory-assembled units. The breakers are of the easily removable and interchangeable type.

Expansion of your power requirements can be handled by adding units electrically matched to the original installation.

LOAD-CENTER
Power Distribution
Systems

Buy all the BONDS you can—and *keep all you buy*

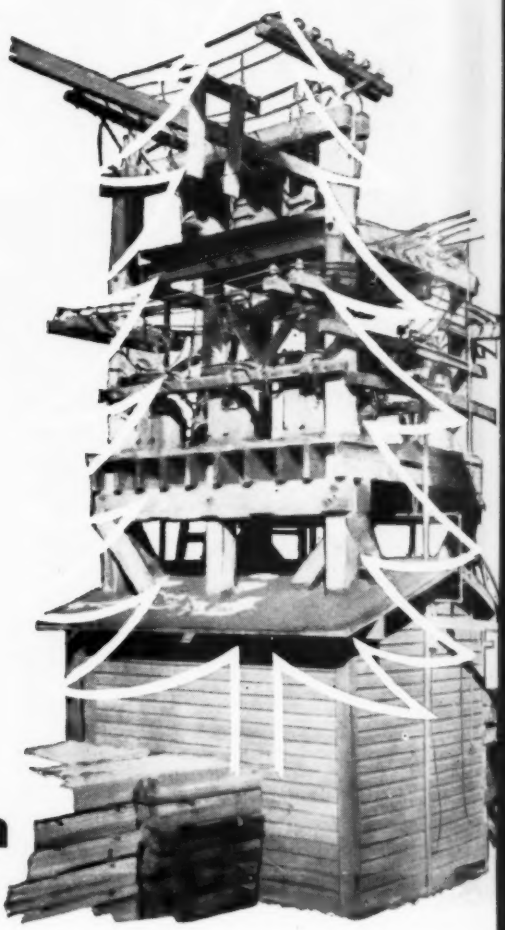
GENERAL ELECTRIC

302-32-5900

Packaged Successor

to

Christmas-tree Design



● G-E UNIT SUBSTATION DOUBLES CAPACITY AT LESS THAN REVAMPING COST

When this lumber mill's load increased, the management first considered revamping a piecemeal-built, wooden-tower substation to double its capacity. This meant making room for three 100-kva single-phase transformers and the necessary accessories, although the old substation impeded yard traffic as it was.

A G-E application engineer reviewed the plans. He showed that a new, factory-built unit substation of 300 kva could be installed for less than the revamping cost. Using a Pyranol transformer section it could be installed indoors, with shorter low-voltage feeders, and greater assurance of uninterrupted service. It meant adequate interrupting capacity, and adequate provision for load growth.

Latest report: "Company is enthusiastic about unit substations and intends to install more."

For complete information on G-E unit substations, see our local representative, or write for Bulletin GEA-3758. General Electric Company, Schenectady 5, N. Y.

UNIT SUBSTATION

✓ —Safely at home anywhere in the plant, thanks to Pyranol or dry-type transformer.

✓ —Interrupting capacity coordinated with transformer rating. Fully metal-enclosed switchgear.

✓ —Built to standard designs by repetitive manufacture. Easy to install and maintain.

GENERAL ELECTRIC

NICKEL AIDS THE MACHINE TOOL INDUSTRY

to KEEP 'EM WORKING!

Everyone marvels at the speed of American production for war . . .

But how many realize that much of the credit should go to machine tool designers?

They are the ones who created the *tools* for doing the job.

They're making production miracles commonplace . . . with the most efficient machine tools that ever whipped raw material into finished product.

And the secret? For one thing, they try to design each component part of a machine so that it outlasts the machine itself.

They know that failure of a single machine in a mass production setup might bring whole assembly lines to a stop.

So they lean heavily on Nickel alloyed materials for the critical parts of machine tools.

Over the years they have learned that Nickel contributes toughness, strength, and fatigue resistance . . . properties vitally essential to many different kinds of tool parts . . . from grinder frames to tail shafts, from gears and spindles to drill chucks and lathe beds.

In the industries which use machine tools, it's an axiom that "a little Nickel goes a long way" to keep 'em working.

Whatever *your* industry may be . . . if you want help in the selection, fabrication, and heat treatment of alloys . . . we offer you counsel and data.

New Catalog Index

New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects—from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

★ *Nickel* ★

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

Stamp Out!

Conventional Steam Trap Troubles

Install DRAINATORS

No longer need conventional steam trap troubles plague production! Install Drainators and end for all time air binding of equipment, troublesome by-passes, variable efficiency and frequent costly repair.

Stamp Out these troubles with Drainator—the advanced steam trap with no moving parts that functions continuously on an unvarying thermo-dynamic principle.

Drainators discharge condensate, air and non-condensible gases quickly—continuously—completely and the gauge glass indicates at a glance that efficient elimination is taking place.

MODEL M-41-S DRAINATOR

Adequate capacity is provided in the Model M-41-S Drainator to handle loads usually placed upon ½ inch traps. Typical Drainator performance is assured in this smaller, lower priced unit which has a magnetic operation indicator that can be installed on either side.

The COE MANUFACTURING Co.
501 BANK STREET
PAINESVILLE, OHIO

DRAINATOR • THE ADVANCED STEAM TRAP

Write for a copy of Bulletin No. 903-A or ask us to send an engineer to discuss your condensate handling problems.

New Bulletins

(*Continued from page* 168)

21 STORAGE BATTERY WELDING—Progressive Welder Co, 3050 E Outer Dr, Detroit 12, Mich. 12-page booklet, entitled "The How and Why of Storage Battery Welding," answers 35 questions on costs, operation, maintenance, design, installation, etc, of battery welding equipment for various forms of resistance welding.

22 WELDING COMPENSATOR—General Electric Co, Schenectady, N. Y. 4-page bulletin No. GEA-4223 describes the CR7503-D157 electronic voltage-regulating compensator for G-E resistance-welding controls.

OTHER EQUIPMENT

23 STEPLESS RHEOSTAT — Wheelco Instruments Co, Harrison and Peoria St, Chicago 7, Ill. Single-page bulletin No. J303-2 introduces the Wheelco Rheotrol, a device to maintain a desired electric power or heat input, or flow of liquids or gases to any process or equipment.

24 ELECTRIC TIMING DEVICES — Wheelco Instruments Co, Harrison and Peoria St, Chicago 7, Ill. 4-page bulletin J403-2 discusses automatic Inputrols, electric timing devices which, when employed with any automatic control instrument having a high and low contact with a neutral position, maintain desired input of electrical power, heat, or flow of liquid or gases to any process equipment. Bulletin No. J402-2 covers the manual type.

25 SWITCHGEAR ASSEMBLIES — I-T-E Circuit Breaker Co, 19th and Hamilton St, Philadelphia 30, Pa. 36-page catalog No. 6002 describes Multumite switchgear with air circuit breakers for service up to 600-v ac or 250-v dc.

26 CLEANING COMPOUNDS—Detrex Corp, 13005 Hillview Ave, Detroit 27, Mich. 16-page booklet emphasizes fundamental practices for economical use of degreasing solvents and describes typical degreaser designs. 8-page booklet, entitled "Detrex-Triad Alkali Cleaners," covers alkali and emulsion cleaning compounds for all metal cleaning jobs.

27 TURBINE CLEANER—Shell Oil Co, 50 W 50th St, New York 20, N. Y. 20-page manual describes a new technique for the solvent cleaning of turbines by Shell Turbo Cleaner.

28 METAL SPRAY EQUIPMENT — Metallizing Co of America, 1330 W Congress St, Chicago 7, Ill. 16-page booklet gives a price list of Mogul metallizing equipment.

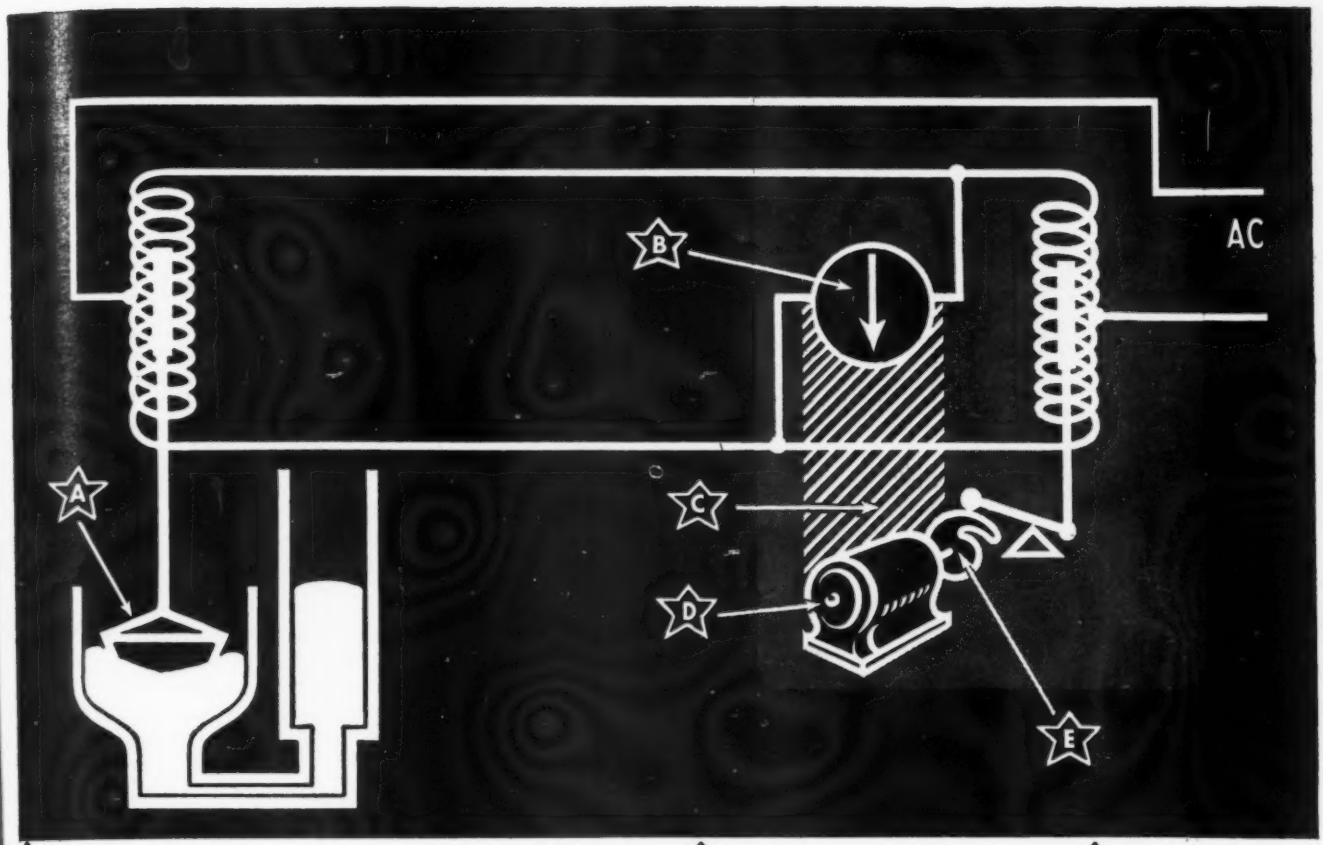
29 LIGHTNING RODS AND ARRESTERS — Inspection dept, Associated Factory Mutual Fire Insurance Companies, 184 High St, Boston 10, Mass. 4-page bulletin No. 15.66, entitled "Ground Testing of Lightning Rods and arresters," discusses methods of protecting electrical equipment from lightning damage.

30 PNEUMATIC MATERIALS HANDLING—Allen-Sherman-Hoff Co, 227 S 15th St, Philadelphia 2, Pa. 4-page bulletin No. 744, entitled "The Facts About Pneumatic Materials Handling in Industry," describes new arrangements for the Hydrovactor unit.

31 STORAGE-HANDLING EQUIPMENT—Bowser, Inc, Fort Wayne 5, Ind. 12-page booklet contains engineering data on liquid storage handling and dispensing equipment.

32 COMBUSTION INDICATORS—Ess Instrument Co, Fort Lee, N. J. 8-page bulletin gives operation and installation information on Ess smoke and combustion indicators.

33 CONDENSER TUBES—Scovill Mfg Co, Waterbury 91, Conn. 55-page bulletin discusses condenser and heat-exchanger tube corrosion, material selection, proper tube installation, packing or rolling, tools and other technical data concerning tube selection and care. Nine text pages and color photographs give lat-



(A) Friction-free Transmitter. Float rests on surface of mercury. (B) Sensitive Jeweled Galvanometer. (C) Mechanical Relay. (D) Powerful Auxiliary Motor. (E) Calibrated Cam insures uniform accuracy.

Study this diagram

Movement of the float (indicating difference in rate of flow) is detected by the sensitive galvanometer (B) which causes the mechanical relay (C) to actuate the powerful auxiliary motor (D) bringing the receiver core to the same position as the transmitter core, and moving pen arm, indicator and integrator to record the change in flow.

No other flow meter has this simple, friction-free principle. It follows that for matchless ACCURACY you need only specify the Cochrane Flow Meter.

It explains the matchless ACCURACY of the Cochrane Flow Meter . . .

We print this diagram as large as we can get it for a very good reason. Once you understand the basic principle of the Cochrane Friction-Free Electric Flow Meter, the secret of its matchless Accuracy becomes plain. Because flow meter accuracy is attained first, by eliminating friction at the manometer and second, by applying ample power to overcome inherent friction in the receiver. Note how friction has been eliminated in the Cochrane manometer. The float rests on the surface of the mercury in the high pressure leg of the manometer, positioning the magnetic core between two reactance coils. There are no stuffing boxes, no bearings, no electric contacts, no solenoid reactions.

•

Write for a copy of Publication 3010 "Flow Meters by Cochrane."

COCHRANE CORPORATION
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SOFTENERS • DEAERATING SOFTENERS • DEAERATORS • METERS • STEAM SPECIALTIES

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prevents slime deposits . . .

In many of the war's largest industrial developments, including virtually all of the Butadiene, Styrene, and Copolymer Plants of the synthetic rubber program and most of the high octane plants, chlorination has been recognized as the most efficient and economical method of preventing heat exchanger fouling by microbiological accumulations.

These modern plants, which have every facility for determining the best methods to employ, have chosen the Wallace & Tiernan Desliming Process.

At lowest cost, minimum of total solid addition, and without interference with existing corrosion control treatments, chlorination is equally effective in fresh as in salt water; in surface as in well water; in cooling towers as in once-through systems.

The Wallace & Tiernan Desliming Process can be used to equal advantage in your plant, whatever the nature of your slime control problem.

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Manufacturers of Chlorine and Ammonia Control Apparatus

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est information on corrosion mechanism and protection methods. Properties of available alloys and recommendations for various classes of service and local conditions are detailed.

34 **DIESEL ENGINES** — Worthington Pump & Machinery Corp, Harrison, N. J. 8-page bulletin No. S-500-B35A gives features, specifications and dimensions of Worthington BB vertical 4-cycle direct-injection diesel engines.

35 **PUMP EQUIPMENT**—Worthington Pump & Machinery Corp, Harrison, N. J. 20-page bulletin No. WP-1095-B37B describes Worthington equipment, including pumps, ejectors, diesel and gas engines, air and gas compressors, air tools, steam turbines, turbine generators, deaerators and deaerating feedwater heaters, etc.

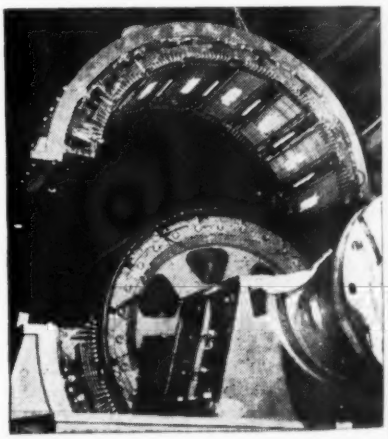
36 **WATER CONDITIONER**—American K A T Corp, 331 Madison Ave, New York 17, N. Y. Folder, entitled "How Much of Your Water Still Capacity Are You Not Getting?" discusses benefits of K A T water conditioner.

37 **ELASTIC STOP NUTS** — Elastic Stop Nut Corp of America, Union, N. J. 124-page catalog and data book covers the hex, anchor and clinch nuts and gives data for the planning of vibration-proof connections.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **EMPLOYER - EMPLOYEE RELATIONS**—Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 44, Pa. 36-page booklet contains an address given by the company president on industrial relations.

For Brazil's Huge Steel Mill



Upper magnet frame of a 4000-hp motor leaves the test stand at General Electric's plant for shipment to the largest steel mill in South America, now nearing completion at Volta Redonda, Brazil. A $65,000,000 project going up alongside a new city for 15,000 persons 75 miles from Rio de Janeiro, annual initial capacity will be 350,000 tons, ultimate capacity 1,000,000 tons of steel ingots.

The dc motor will drive a mill producing structural shapes for Brazil's growing merchant marine and industries and for rails to extend railroad facilities into the interior. International GE will supply main drive equipments for the hot strip mill, the continuous cold mill, control equipment for auxiliaries, numerous general-purpose motors and two 5000-kw steam turbine-generators for the power plant.

...LIKE PUTTING RABBITS INTO A HAT

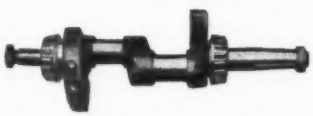
SQUEEZING large air capacity into a small space is a good deal like putting rabbits *into* a hat.

Yet, that's exactly what Gardner-Denver engineers accomplished in designing their "WB" Vertical Two-Stage Compressors. Able to fit into a space only 5 feet square, these efficient compressors have an air output comparable to that of large two-stage Horizontal Compressors. They permit valuable savings in floor space that eliminate the necessity of rearranging crowded plant floors to accommodate them.

Distinctively designed, the "WB" uses two low pressure cylinders in conjunction with each high pressure cylinder. This construction permits the use of small, lightweight pistons in all cylinders, considerably reducing the inertia load and making possible the reduction in compressor size without sacrifice of capacity.

★

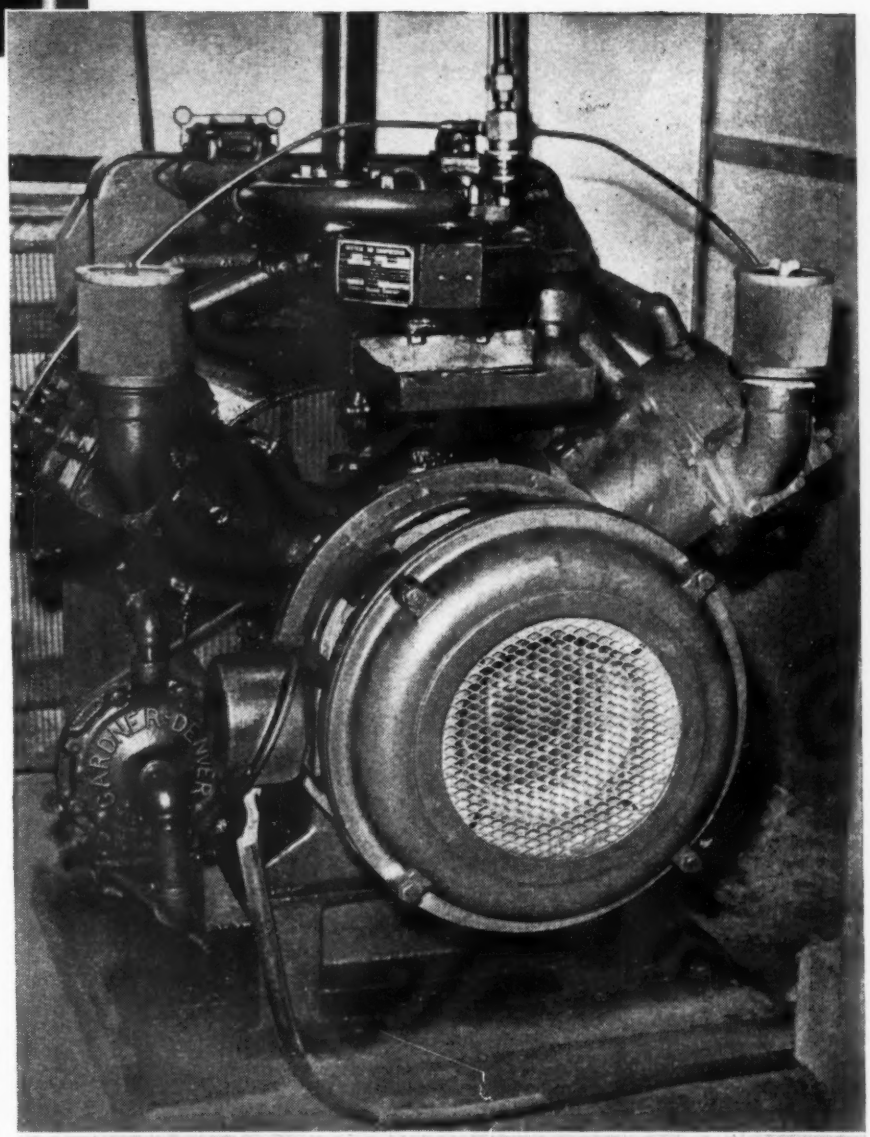
NOTE THESE FEATURES:



1. **Drop forged crankshaft mounted on Timken roller main bearings.**

OTHER "WB" COMPRESSOR FEATURES

2. **Built for service with castings of Gar-Durloy for extra strength and hardness.**
3. **Fully water-cooled cylinders for lubrication oil economy and lower discharge temperatures.**
4. **"Cushioned" Duo-plate valves are silent . . . assure maximum efficiency and lowest power consumption.**



For complete information on Gardner-Denver "WB" compressors, write Gardner-Denver Company, Quincy, Illinois.

GARDNER-DENVER

Since 1859

Here's where DARTS are Different

Two Bronze Seats — Ground to a True Ball Joint

Two bronze seats accurately ground to insure true ball joining make Dart the *better* union. It will sit tight indefinitely, yet is ready to be moved instantly whenever you have a new job for it. Body and nut—made of high-test air-refined malleable iron—are practically unbreakable. Darts are purposely built to give longer service . . . thus, in the long run, cost less. Call your supplier.

Good pipes become a good piping system when you use Dart Unions.

DART UNIONS

DART UNIONS LIVE LONGER

E. M. DART MFG. CO., Providence, R. I.

Readers' Problems

(*Continued from page* 112)

exceeds 125 psi. Boiler codes do not generally specify any particular blowoff valve except to prohibit use of globe valves. When maximum allowable working pressure exceeds 125 psi most codes require that each blowoff line shall have two valves, or a valve and cock, except on boilers with multiple blowoff pipes. Here a single master valve may be placed on the common blowoff pipe, and only one valve on each individual pipe.

Use extra heavy pipe and fittings for blowoff lines and make renewals or replacements in accordance with code rules for new installations. Quick-opening valves for this service afford no particular advantage except ease of operation.

Jersey City, N. J. I S CHAMBERLAIN

Master Valve Must Be Slow Opening

INSTALL A VALVE on each blowdown leg from the boiler to give each side an effective and individual blowdown. This prevents the possibility of one leg becoming clogged and ineffective.

Either quick- or slow-opening valves may be used provided the master valve is the slow-opening kind. Otherwise, slow-opening valves must be used.

Principal reason for using quick-opening valve is lower cost and ease of operation. It acts as an auxiliary valve and should be opened first to enable the slow-opening valve to be opened and closed under pressure.

Lawrence Harbor, N. J.
ARTHUR CANNON

Scale Erodes Blowdown Valve

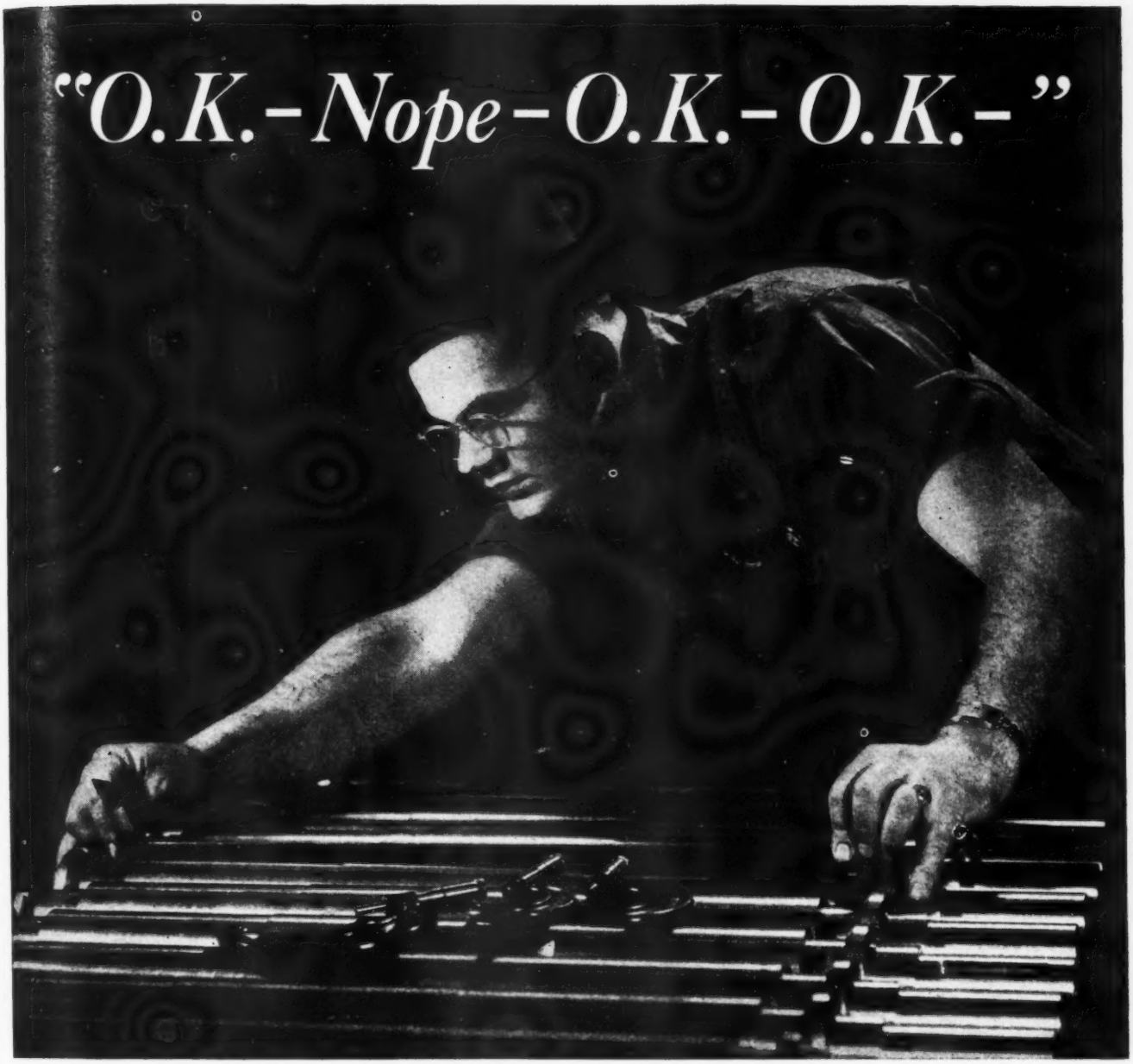
SAFE AND PRACTICAL ARRANGEMENT is two valves, a special blowoff valve, and either a quick-opening or a gate valve in each branch between boiler and blowoff main. The quick-opening or gate valve should be located next to the boiler.

The reason why the valves next to the boiler are opened first and closed last is to reduce wear so that they can be depended upon to hold pressure when the regular blowoff valves are being repaired. Wear on these valves is severe when scale and sediment are present.

New York, N. Y. ANTHONY GREER

(*Continued on page* 180)

"O.K.–Nope–O.K.–O.K.–"



TO WATCH HIM operate, you'd think Walter Conner of Allis-Chalmers Norwood Works was conducting a one-man scrap drive.

Not that he finds many defective motor shafts in the course of a day's inspection — but he sure *looks* for them. And when he finds one — bang — it lands on a scrap pile.

In a way, it's the group of motors we *didn't* build that's behind the reputation: "You can depend on Allis-Chalmers Motors!"

But actually, building consistently great motors requires far more than rejecting parts and assemblies that don't come up to Allis-Chalmers standards . . . because there are dozens of points in every motor that *can't be tested* by known methods or instruments.

How can you test the honesty and skill with which a rotor end connection was silver-brazed in depth . . . a hidden coil assembled?

You *can't.*

That's why we're glad Allis-Chalmers craftsmen know today — as they've known for years—that they have a big personal stake in every motor they build for you.

They know that when they build great motors they're making *friends* . . . and that no company and its workers can have too many of them.

Next time you need the kind of extra-quality (but not extra-price) motors Allis-Chalmers builds, check with our nearby district office. Or write direct to ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

• • •

♪ *Tune in the Boston Symphony, Blue Network, Saturday at 8:30 pm, EWT.*

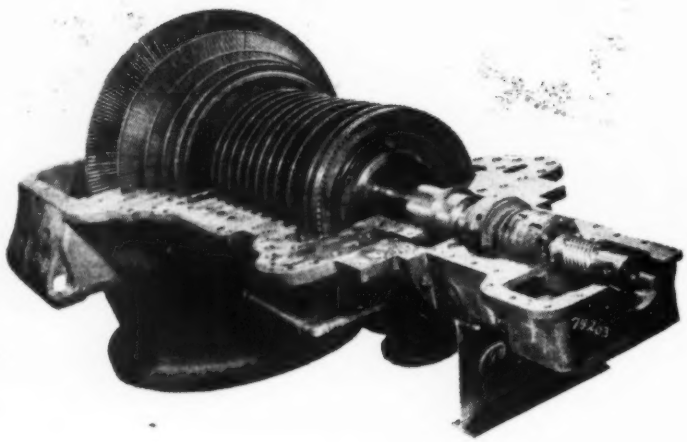
AC WE WORK FOR VICTORY WE PLAN FOR PEACE

A 1727

YOU CAN DEPEND ON ALLIS-CHALMERS MOTORS

MURRAY

MULTISTAGE STEAM TURBINES



This internal view shows the ruggedness, design, and fine workmanship that is built into every Murray turbine, from the largest to the smallest of units. While the machine shown was for generator drive, similar designs may be furnished to drive centrifugal compressors or pumps in the larger sizes.

Four 2500 KW 3600 RPM straight condensing turbines, designed to operate on steam at 600 pounds initial pressure, 750 degrees total temperature and exhausting to 29 inches Hg. vacuum were furnished to a Mid-Western plant a number of years ago, together with a number of smaller units for auxiliary drive.

Consider MURRAY for your prime movers for that new plant, or expansion. There is a MURRAY Representative handy to help you plan. He will welcome your problem.

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA
Builders of Steam Power Equipment for Three Quarters of a Century

Arrangement Is Incorrect

VALVE ARRANGEMENT shown in BW's sketch is incorrect. Two valves in each line would be a good hookup, but according to ASME Power Boiler Code one quick-opening valve can be used in each branch line and a slow-opening master valve in the main line.

As most state laws and city ordinances follow this Code any safety devices installed according to it usually pass any city, state or insurance inspection.

Purpose of opening the quick-opening valve first and closing it last is to protect the valve gate and seat. With pressure equalized on both sides of the valve, the seat and disk are not forced against each other when the valve is opened or closed. Sand or scale between the faces will cut grooves and start the valve leaking.

Lombard, Ill. H D BROWN

Use 45-Degree Ells

COMMON METHOD of setting up blowoff connections is to install a quick-opening valve in each pipe and a slow-opening one in the common discharge.

Using 45-deg ells to connect the second line reduces pipe strains below that encountered with 90-deg fittings.

Salt Lake City, Utah R C BAILEY

Needs Only One Line

IT IS USUALLY CUSTOMARY for manufacturers to allow duplicate sets of connecting holes for feedwater line, blowdown line and water column. This permits the purchaser to make connections to whichever side of the boiler is most convenient. Evidently BW's contractor was a bit too enthusiastic because only one blowdown line is needed.

You can use either one slow- and one fast-opening valve or two slow-opening valves. Place valves as close to the boiler as practicable, yet allow enough room for operators to get to them in a hurry. If you are unable to procure a fast-opening valve it is just as safe to use a slow-opening one.

Brooklyn, N. Y. A J WENIG

Present Hookup Gives False Indication

VELOCITY OF WATER leaving the boiler in either branch is lower than that in the main blowoff line, therefore it gives a false impression of the velocity of water leaving the boiler. The slow-opening valve is more or less subject to abuse and is made so that it can

POINTERS ON PIGSKIN CHAMPIONS

A team that works smoothly together, balancing sound defense with driving power . . . A coach who can mastermind a plan of action, make lightning decisions . . . Equipment that gives maximum protection *plus* speed. That's the combination of *men, methods* and *materials* that makes champions.

You get insulation efficiency the same way

● All the elements *properly coordinated*—men, methods and materials. This is the RUBEROID way to assure maximum service from industrial insulation.

MEN . . . The right men are all-important. Skilled mechanics in the nationwide organization of Ruberoid Approved Applicators handle the jobs. These men know their business. They've licked the most difficult insulation problems.

METHODS . . . Each installation is "tailor-made" to meet the individual job. Ruberoid engineers are not wedded to any one method. You get the benefit of broad experience with all possible methods of application.

MATERIALS . . . The right insulation material to meet your specific temperature control problem. The Ruberoid insulation line has no "gaps" in it from 0° to 1900° F.

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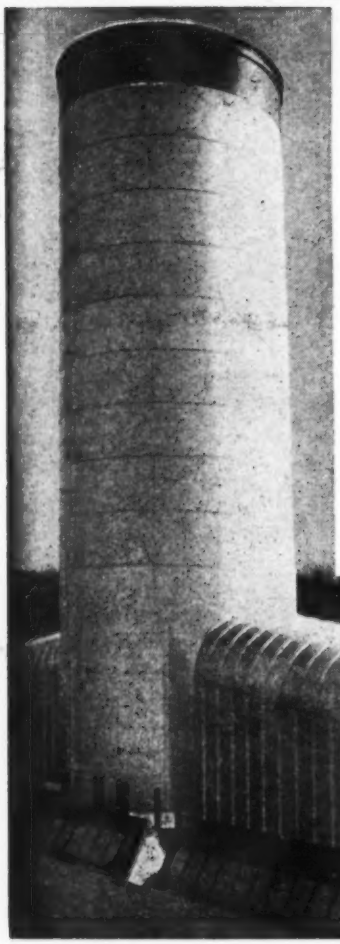
ASPHALT AND ASBESTOS BUILDING MATERIALS

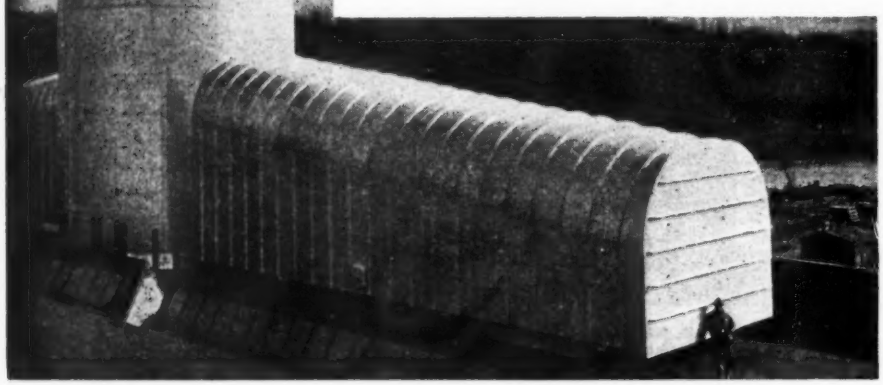
For V-DAY BUILDING

BENEFIT BY CONNERY V-STIFFENED NON-BUCKLING LEAKPROOF BREECHINGS . . . .



We take pardonable pride in the fact that 100% of Connery output is going to war production projects. And we feel certain that the many plants using (and planning to use) Connery's Improved Expansion Stiffened Construction for stacks, breechings, ducts, etc., won't mind if we give our best to "our first customer," Uncle Sam.

As government priority construction slackens, however, we will be in a position to offer old and new customers specific help on their problems of power plant construction.



STACKS
•
BREECHINGS
•
UPTAKES
•
HOPPERS
•
AIR DUCTS

RECENT INSTALLATIONS

NEW HAMPSHIRE GAS & ELECTRIC CO.,	PORTSMOUTH, N. H.
UNITED ILLUMINATING CO.	BRIDGEPORT, CONN.
ROCHESTER GAS AND ELECTRIC CO.	ROCHESTER, N. Y.
INDIANAPOLIS POWER & LIGHT CO.	INDIANAPOLIS, IND.
CONSOLIDATED GAS ELEC. LIGHT & PR. CO.	BALTIMORE, MD.
VIRGINIA PUBLIC SERVICE CO.	ALEXANDRIA, VA.
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CONNERY CONSTRUCTION CO.
Second and Luzerne Sts. Philadelphia, Pa.

CONNERY
EXPANSION STIFFENED
CONSTRUCTION

take it. Two slow-opening valves may be used. It would also be permissible to use a single master valve in the common blowoff line and only one valve at each boiler connection.

Buffalo, N. Y. THOMAS BREEN

Use Quick-Opening Valves Properly

IN ANSWER to BW's question regarding blowdown valves, I quote from ASME Power Boiler Code, Paragraph P-311: "On a boiler having multiple blowoff pipes, a single master valve may be placed on the common blowoff pipe from the boiler, in which case only one valve on each individual blowoff is required. In this case either the master valve or the individual valves or cocks must be slow-opening.

Quick-opening valves are cheaper, take up less room, provide a straight path for flow, do not collect scale and sediment, give long trouble-free service when used properly.

Wausau, Wis. D KINCAID

Answers to Q 2—What Causes Ammonia Temperature to Vary?

(*Continued from page* 113)

from point D to D^1, or from 74 to 70 F.

As head pressure increases upper curve rises vertically, and with the same quantity of water flowing at the same entering conditions, discharge water temperature increases and liquid refrigerant leaves at a higher temperature. This tends to lower refrigerant effect per pound circulated. Under ordinary operation as compared to a deslimed-tube condition amount of refrigeration per brake horsepower is less. Subcooling does not increase horsepower consumption.

Because of water velocity slime does not build up beyond a thin layer. But this is enough to effect liquid subcooling. System is operating normally and there is no need for concern.

Cliffside Park, N. J.
J D CONSTANCE

Pump Capacity Is Adequate

BHT HAS NOTHING TO WORRY ABOUT if conditions are as stated. Every shell and tube condenser is a heat exchanger. When the substance being cooled leaves at approximately the same temperature as the discharge water, the condenser is doing a pretty good job.

The fact that for several days after cleaning the liquid ammonia tempera-

COTTRELL PROCESS

of

ELECTRICAL PRECIPITATION

universally recognized as a
standard method of removing

DUST, FLY ASH, FUME, MIST & FOG

***from* GASES**

•

30 years of research, development and operating experience thoughout the world are incorporated in the

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offered to meet the requirements
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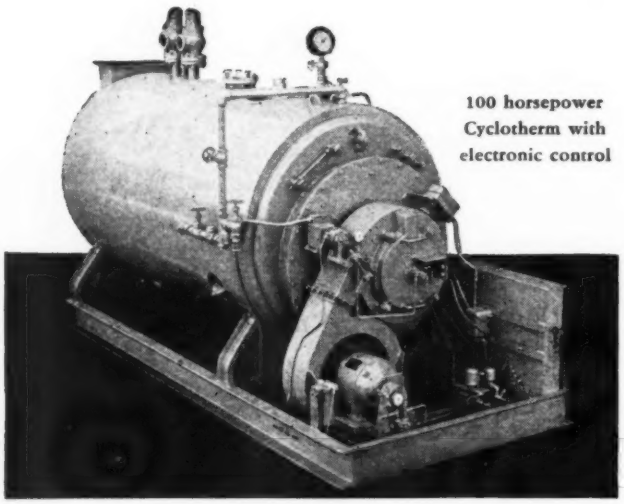
DOLLAR EFFICIENCY—work done per dollar spent—measures the value of steam generation

Exclusive principles of combustion and design have given Cyclotherm an outstanding record of efficiency and economy among steam generators. Because of its combustion principles and design, Cyclotherm meets the dollar efficiency test throughout its wide power range (10 to 300 horsepower) in units that are both oil and gas fired.

Whether used for power, processing or heating, a Cyclotherm makes an enviable record in steam production per unit of fuel consumed.

Cyclotherm Steam Generators are fully automatic, strongly built and fully self contained. They will give you years of trouble-free service for they are designed and constructed for exacting service with a minimum of attention.

While the range of available units obviously cannot be on a peacetime basis, if you are planning immediate replacement, our engineers will gladly cooperate in meeting your needs. Any additional information desired will be supplied promptly.



100 horsepower Cyclotherm with electronic control

CYCLOTHERM
STEAM GENERATOR

AMES IRON WORKS
OSWEGO . . NEW YORK . . BOX 602

ture is lower indicates that plenty of water is being supplied and I would not recommend an additional pump. The very slightest film of slime, mud or scale makes a difference of several degrees. Merely scraping the tubes, as compared to scraping and then following through with a brush, demonstrates this.

Just recently the writer had occasion to check similar temperatures at one of our plants. We were supplying 500 gpm of water from a cooling pond to a 5-pass condenser carrying about a 70-ton load. Water on the condenser was 73 F, off the condenser 80 F; liquid ammonia leaving condenser at 81 F. We consider it a normal and good operating condition.

New Rochelle, N. Y. A B DURYEE

Condenser Is Oversized

TEMPERATURE READINGS seem to indicate that BHT's condenser is considerably oversized, and is therefore able to show unusual efficiency in cooling the ammonia for a short period after cleaning the tubes. The small variation in head pressure could be expected because the difference in ammonia temperatures is likewise small. However, the 4 F drop in ammonia temperature after the tubes are cleaned decreases the pressure about 9 psi.

This temporary increase in heat transfer is probably aided to a large extent by the comparatively low head pressure and corresponding low ammonia temperature under which the system operates. The conditions may be the result of reaching a critical point in the condenser's capacity under the prevailing operation and would not be so likely to occur if both head pressure and inlet-water temperature were higher. Inasmuch as the condenser's high efficiency can be obtained only when the tubes are perfectly clean, it is naturally of short duration and falls away rapidly as soon as the tubes accumulate even a slight coating of slime.

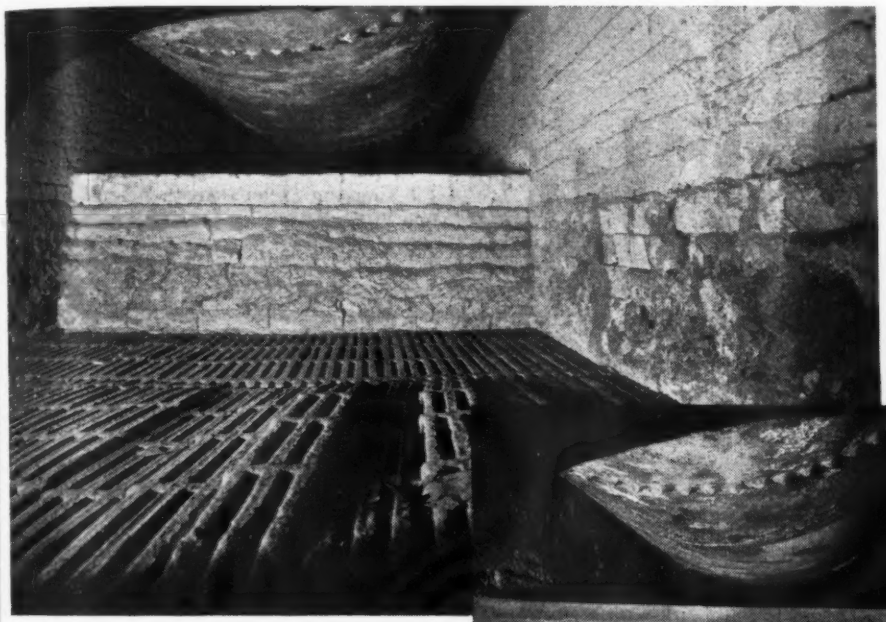
Effects of tube cleaning are sometimes quite pronounced on counter-flow units. Here it appears that a thorough job of tube cleaning is required about every four days to reduce head pressure 7%. It is doubtful whether the saving thus obtained would compensate for the additional labor involved.

Considering that the condenser, under present operating conditions, is delivering ammonia at practically the same temperature as the outgoing water, it seems clear that no additional pumping equipment is required as better results could scarcely be expected.

Jersey City, N. J. I S CHAMBERLAIN

For Bricks that stand the gaff . . . *order CRYSTOLON*

In many installations CRYSTOLON Brick pay for themselves in one year. These silicon carbide brick made by Norton Company are made to stand up under severe operating conditions in stoker-fired furnaces, generators of water gas sets and combustion chambers of high temperature furnaces.



(Left) Ordinary brick, after a period of three years in one of a pair of heating boilers, are in poor condition and a troublesome "shutdown" is necessary.

(Right) CRYSTOLON Brick after the same period of service in the other boiler are still in excellent condition, will give many more years of uninterrupted service.

CRYSTOLON Brick are particularly resistant to high temperatures and to the chemical action of molten slag. Because of exceptional density they resist the penetration of molten ash. Ruggedness enables CRYSTOLON Brick to resist the abrasive action of ash and the motion of the fire bed in stoker-fired furnaces.

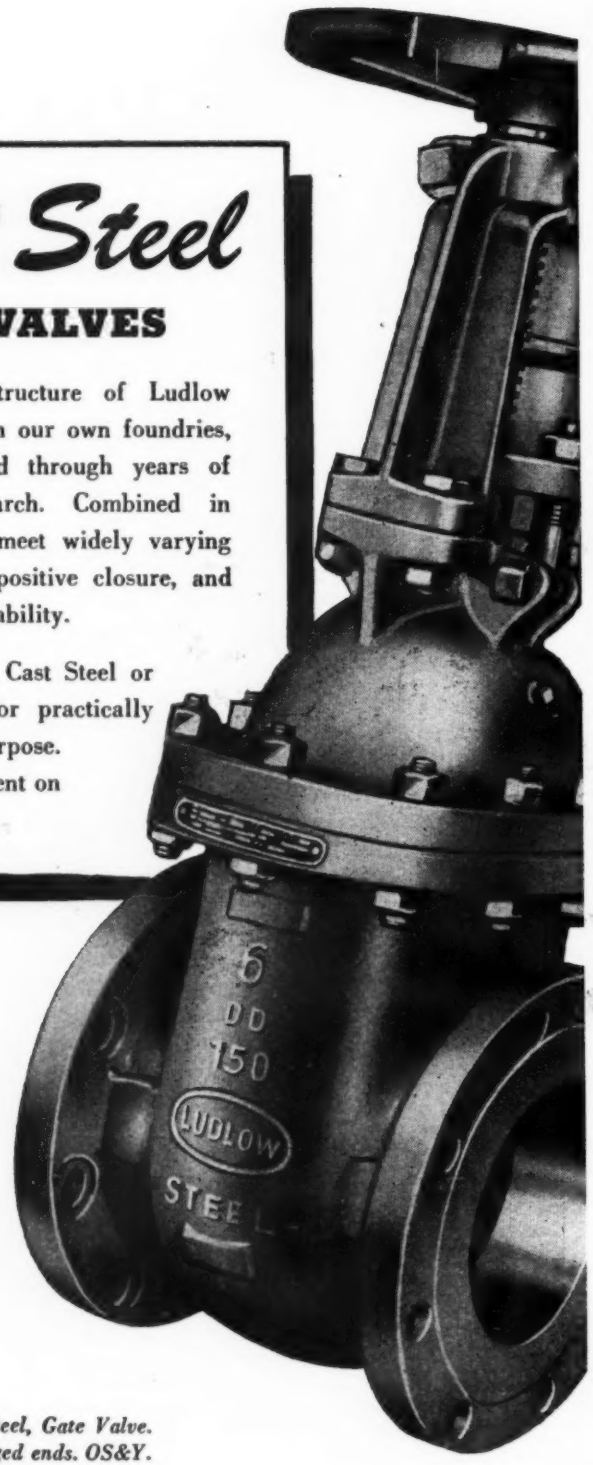
NORTON COMPANY **Worcester 6, Mass.**

Norton Longer Lasting Refractories

Cast Steel
GATE VALVES

The dense-grain structure of Ludlow Steel Valves, cast in our own foundries, has been developed through years of metallurgical research. Combined in Ludlow design to meet widely varying temperatures with positive closure, and long-lasting dependability.

There is a Ludlow Cast Steel or Cast Iron Valve for practically every industrial purpose. Complete catalogs sent on request.



Ludlow Fig. 1571. Cast Steel, Gate Valve. Bronze mounted, with flanged ends. OS&Y. Steam working pressure, 150 lbs. at 500° F.

P-2

The LUDLOW VALVE MFG·CO·INC· TROY·N·Y·
SINCE 1866

Argument Corner

(*Continued from page* 124)

coupled to a 500-kw dc generator and 200-kw auxiliary. Juice was supplied to the 95-rpm main motor aft at 220 volts.

The electric auxiliaries, bilge pumps, general service pumps, etc, were abaft of the engine generators on the main floor plates. The control platform and the switchboards were located on the first grating, with an auxiliary generator driven by a Gardner engine. Above these was the CO_2 refrigerating equipment and further on the main deck, stood a two-furnace Scotch marine boiler.

Compact? Yes indeedy. Up-to-date, she was the all-electric wonder ship, built at Cammel-Lairds, Birkenhead, England. The year she came to these shores first was 1923.

Cards and More Cards

On that ship it was *indicator cards*. If a wisp of discoloration flowed from the funnel, it was indicator cards. If the scavenge pumps pumped, it was cards. If the fuel-valve travel increased or decreased, it was indicator cards. Those marvelous little slips came in volumes, and the cards were taken in volumes, likewise.

Ah! The process of taking the cards was something bordering on the heroic. First you laid a coconut mat and tarpaulins over the exhaust manifold, then you crawled away under the scavenge pump, and you played with this little ticker and that thingumybob. Then the wee cock was opened, and you played yourself taking the cards.

If we ran one engine six hours without stopping, that trip became historical. We cheered Jessie (that was No. 4 engine) because she ran all the way from Scotland Light to Cape Three Points at Barrios, Guatemala. We hung brass medals on the engines for good performance, and on the other hand we lambasted and malabruised them bloody engines if they conked out.

One evening we had cast off at Puerto Castilla, Honduras, and were heading out from the pier. I slid down the ladder to have a look-see at Jessie. There was nothing about her running that made me feel my sixth sense had forsaken me. I wandered around, observed this and that, then thinking I should slip one of the round inspection plates off the large aluminum crankcase doors, I proceeded to do so. As the plate came away from the main door, a thick, white, heavy vapor flowed out and around my hand. That gas had the appearance of CO_2 gas used in refrigeration. I took off the

THE TUBE THAT MADE

MECHANICAL-ELECTROSTATIC

DUST COLLECTION POSSIBLE

THE Duplex Dust Collector is like a double-barreled shotgun! "Why?"

Because it takes two barrels to get real results—the second barrel hits what the first one misses.

That, briefly, is the story of the new Thermix Duplex Collector. It combines *both* mechanical and electrostatic principles but its size is only slightly larger than the conventional mechanical units. And it *gets* results—94.66% *total* dust elimination, as proved by actual tests on extremely fine pulverized fuel dust! Dust escaping from this collector need never worry you even if dust ordinances and health requirements become increasingly severe. It solves your problem—economically—once and for all.

If desired, only the mechanical section of the Thermix-Duplex need be installed at the outset. Should greater efficiency be required, the secondary section can be added at any time. Furthermore, the Duplex is so designed that the mechanical unit *alone* will give high dust collection while the circuit of the electrostatic unit is being cleaned.

Write for bulletin giving engineering data.

•

THERMIX ENGINEERING COMPANY

Project and Sales Engineers

FIRST NATIONAL BANK BLDG., GREENWICH, CONN.

PRAT-DANIEL CORPORATION

EAST PORT CHESTER, CONN.

CUSTOMERS ARE CLOCK WATCHERS—

DON'T let your reputation for promptness lie around on the shipping room floor. When a customer marks his order "RUSH"—call for AIR EXPRESS pick-up *and get it on its way as early in the day as possible!* That's the secret of fastest delivery by AIR EXPRESS—a service that moves cargo on swift Airlines schedules around the clock, for war and reconversion jobs.

SPECIFY AIR EXPRESS
A Money-Saving, High-Speed Tool for Every Business

With additional planes and space available for all types of traffic, 3-mile-a-minute Air Express directly serves hundreds of U.S. cities and scores of foreign countries. And shippers nationwide are now saving an average of more than 10% on Air Express charges—as a result of increased efficiency developed to meet wartime demands.

WRITE TODAY for "North, East, South, West"—an informative booklet that will stimulate the thinking of every executive. Dept. PR-10, Railway Express Agency, 230 Park Avenue, New York 17, N. Y., or ask for it at any local office.

AIR EXPRESS
Gets there FIRST

Phone RAILWAY EXPRESS AGENCY, AIR EXPRESS DIVISION
Representing the AIRLINES of the United States

next plate, and the same gas came out.

Up I went to the control platform, and told what I had seen. Down trooped every son of an engineering seacook, and they all flocked around the crankcase doors. Then the Chief took off the plate, and again out flowed that white muck.

Indicator cards was the order. We crammed around that blasted diesel mule, cussing and grunting. On went the indicators. On went the cards. Off came the cards. Then we cluttered around the brains, listening to this version and that version of what MIGHT be the trouble. Out came the bulldozer, out came all the little wrenches, the hammers and the chisels. On went the old crappy togs used for such work. It was Friday evening when we started to take the No. 4 cylinder pistons out. Now if it were only the pistons to be removed, that would be easy, but to lift the pistons out, it was necessary to take out all the bolts which held down the scavenge pump, and lift that blasted pump up and across the top of the air compressor. By that time the ship was clear of Truxillo Bay, and heading into the swells of the Caribbean.

Out Came the Pistons

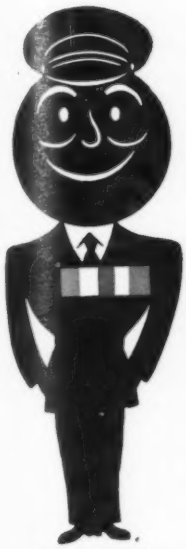
We drew out them there pistons, then proceeded to draw out the cylinder liner to inspect the dexine rings. Remember this was No. 4 cylinder we were working on. The rings were found in good order, then back went that liner. In went the pistons, and they were bolted—upper to the scavenge pump and lower to the main crosshead. In went the trombone pipes. Over slipped the scavenge pump, and the engine was once more boxed up and ready for running.

The signal given, over went the air-starting lever, then the oil, and off went Jessie like a house afire. Ah, it was nice to hear her run. I liked that deep bonk-bonk sound inside. Out of the dreaming we came like a shot! Down to the floor-plates we slipped. Off came the inspection plates, and out came the same bloody gas. We climbed up the ladder, and pulling the trip lever, stopped Jessie. Next we started on the No. 3 cylinder, and the same process. Cussing and heaving, heaving and cussing. Out came that cylinder liner, and back she went with the OK signal. Up started Jessie. She was a good engine; never failed to start. Then again out came the indicator, and once-twice-thrice the cards were taken off. Verdict after verdict was laid out. Whatinell was the trouble? Down again to the inspection plates, and once again out swung that beautiful, heavy, white vapor.

By this time we were on six-hour watches, and getting our grub on the

PHYSICAL AND CHEMICAL PROPERTIES

PIN A MEDAL ON *Yourself!*



"Mr. Dag"

You get far more than just a smooth, black liquid concentrate when you use Dag colloidal graphite. A versatile group of valuable properties is also at your service. The most important of these properties are listed here. A color and a number is given to each for easy reference.

In the typical applications below, trace the record of some of these properties. You can do this simply by matching the ribbon colors against the property chart.

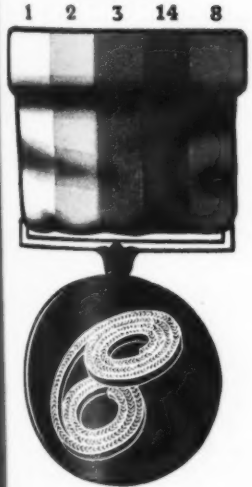
1 3 14 13 15

1, 3, 14, 13, 15
CITATION: "Die and punch life is increased and forgings having better finish are produced to closer tolerances with Dag colloidal graphite treated lubricants."

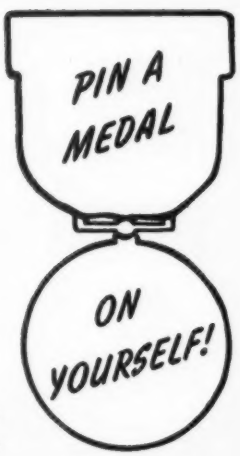
2 6 14 13

2, 6, 14, 13
CITATION: "Excellent electrical contact is obtained between copper oxide discs and adjacent metal electrodes in rectifiers when dry coatings of Dag colloidal graphite are used on the crystalline oxide surfaces."

1 2 3 14 8



1, 2, 3, 14, 8
CITATION: "Dag colloidal graphite is extensively used to impregnate asbestos packings for pumps handling chemicals and explosive fluids. It protects the packing against chemical action and provides safe, dry lubrication."



Check this list

and pick out those properties which you can use. Then state your problem to us and let our engineers give you the benefit of their experience. It is quite possible that they have already studied a parallel application. You'll pin a medal on yourself for calling in Mr. Dag.

Dag, Oildag, Aquadag, Glydag, Castordag and Prodag are registered trade marks of Acheson Colloids Corporation. Copr. 1944 by Acheson Colloids Corp.

dag
REG. U.S. PAT. OFF.
COLLOIDAL PRODUCTS

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

1
Slippery—a Good Lubricant. Softer than talc

2
Conducts Electricity

3
Withstands Temperature Extremes

4
Absorbs, Radiates and Conducts Heat

5
Maximum Purity

6
Low Coefficient of Expansion

7
Particles Bear Like Electric Charges

8
Insoluble in Acids and Alkalies

9
Black and Opaque

10
Gas Adsorbent

11
Little Photoelectric Effect

12
Miscible with Most Fluids

13
Films Adhere Tenaciously and Dry with Sharp Edges

14
Microscopically Fine Particles. Penetrates Fine Pores

15
An Excellent Suspension

WE KNOW THE PIPING PROBLEMS

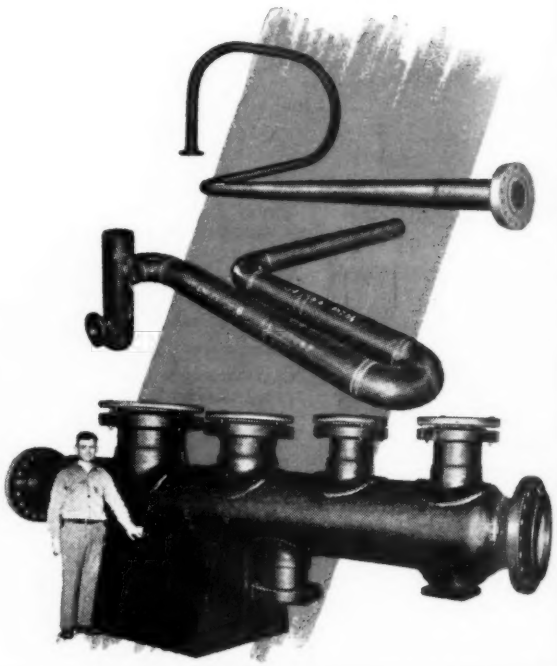
from BOTH SIDES of the Desk

Midwest not only fabricates piping for all purposes, but also operates an experienced contracting department that will deliver to the customer a completely installed piping system—ready for operation. Consequently, we have a clear view of piping problems from both sides of the desk.

Our contracting department is ever ready to make *practical* suggestions for improving pre-fabricated piping subassemblies. This continuous interchange of information and suggestions helps keep the entire Midwest organization on its toes; it is important in maintaining the high quality of Midwest piping.

Our contracting department is in constant and intimate touch with piping users in all types of industry. Changes in piping requirements . . . changes in the thinking of users are quickly relayed throughout the entire Midwest organization.

Midwest has four modern pipe fabricating plants strategically located to serve you . . . whether you need a simple bend or piping for an entire plant completely erected and ready for operation.



MIDWEST

PIPING & SUPPLY CO., INC.

Main Office: 1450 South Second St., St. Louis 4, Mo.

Plants: St. Louis, Passaic (N. J.) and Los Angeles • Subsidiary: Lumsden & Van Stone Co., South Boston 27, Mass. • Sales Offices: New York 7—(Eastern Division) 30 Church St., Chicago 3—645 Marquette Bldg. • Los Angeles 33—520 Anderson St. • Houston 2—229 Shell Bldg. • Tulsa 3—533 Mayo Bldg. • Atlanta 3—Red Rock Bldg. • South Boston 27—426 First St.

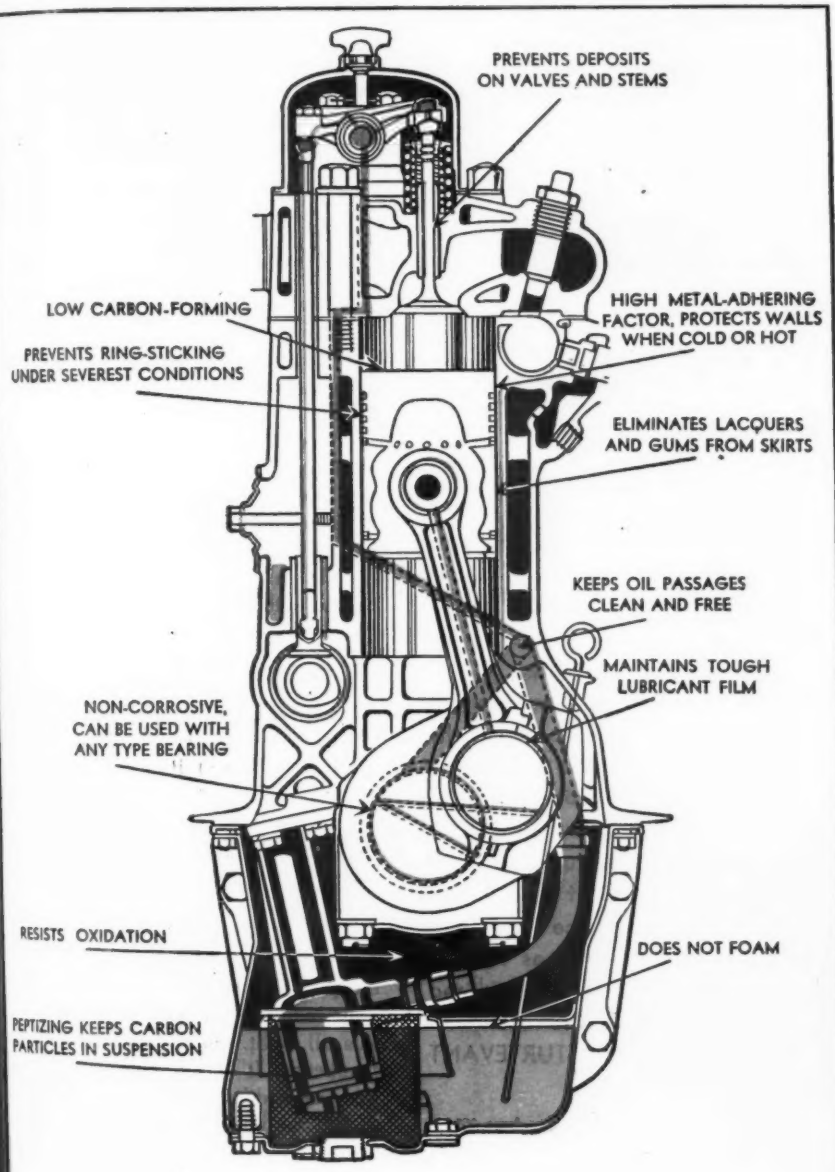
Piping Fabricators and Contractors

TYPICAL DIESEL LUBRICATION PROBLEMS:

4. Removal of Deposits from Engines

RPM DELO will clean your engine of sludge and other deposits, even in the ring-belt, unless accumulations of carbon, gum, varnish, etc., have cemented rings so tightly that oil cannot get behind them. The following procedure is recommended for purging conventional engine systems:

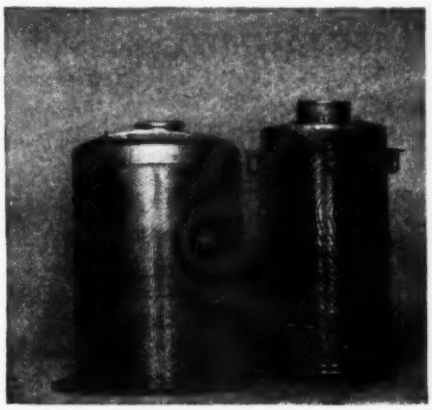
1. Drain present oil from crankcase while hot.
2. Renew filter element to trap abrasive particles that may be carried in circulation during purging.
3. Fill crankcase with RPM DELO.
4. Run engine at fast idle for two hours, maintaining water jacket temperature of approximately 200° F. minimum.
5. Drain again while hot and refill with RPM DELO.
6. Place engine in regular service and drain at one-half normal drain period or 750 miles, whichever comes first, for two or three drains. Check oil frequently as removal of deposits may temporarily increase oil consumption.
7. Drain while hot. Check oil filter and replace when necessary.
8. Refill with RPM DELO, returning to regular oil drain and filter change period, and continue to use RPM DELO.


PREVENTS DEPOSITS ON VALVES AND STEMS
LOW CARBON-FORMING
PREVENTS RING-STICKING UNDER SEVEREST CONDITIONS
HIGH METAL-ADHERING FACTOR, PROTECTS WALLS WHEN COLD OR HOT
ELIMINATES LACQUERS AND GUMS FROM SKIRTS
KEEPS OIL PASSAGES CLEAN AND FREE
MAINTAINS TOUGH LUBRICANT FILM
NON-CORROSIVE, CAN BE USED WITH ANY TYPE BEARING
RESISTS OXIDATION
DOES NOT FOAM
PEPTIZING KEEPS CARBON PARTICLES IN SUSPENSION

This diagram of a typical Diesel engine shows how RPM DELO keeps rings free and maintains clean operation.

RPM DELO is made from base oils especially selected for non-deposit-forming characteristics, and contains a detergent which keeps foreign particles in suspension. It also contains an anti-oxidant which prevents the formation of gums and lacquers. It is non-corrosive, may be used with any type of bearing.

RPM DELO has world-wide distribution and is marketed under the following names: RPM DELO, Caltex RPM DELO, Kyso RPM DELO, Signal RPM DELO, Sohio RPM DELO, and Imperial RPM DELO (Concentrate). Ask your Diesel engine manufacturer or distributor for the name of the RPM DELO supplier in your vicinity.



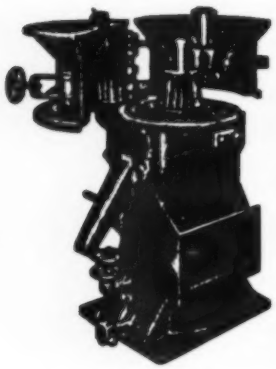
The typical cleanliness of engine parts when RPM DELO is used is illustrated by this oil filter removed from an engine used in heavy duty Diesel bus service for 50,000 miles. Oil pump screen and valve chamber were comparably clean.

RPM DELO

STANDARD OF CALIFORNIA

IT USED TO TAKE 32 OPERATIONS

TO GET THIS COAL SAMPLE!



BUT NOW YOU CAN CRUSH AND SAMPLE

1 TON IN 1 HOUR

WITH THE

STURTEVANT *Automatic*

CRUSHER *and* SAMPLER

HERE IS THE IDEAL COMBINATION TO SPEED LABORATORY CONTROL AND INSURE RESULTS !

Times change! It used to be ok to have one or two men devote hours to "sampling" a pile of coal. But today you can get BETTER results — FASTER — delivered to your laboratory by the Sturtevant Equipment shown here. This is MODERN equipment. It meets the modern demand for a better quality coal to meet the increasingly SPECIFIC requirements of modern plants. The FIRST STEP in laboratory-control of coal QUALITY is to get accurate samples quickly and at low cost. This the Sturtevant Coal Crusher and Sampler does without hand labor. Proven by the test of actual service in modern collieries. Can be depended upon as reliable equipment. Simple, rugged, easily adjusted and maintained — and ACCURATE. The ideal combination with this Sampler is the STURTEVANT FINE GRINDER.

(Refer to our "AD" in the August issue of Power—Page 209)

Investigate the "STURTEVANT WAY"—NOW!

Send at once for illustrated booklet containing valuable information on coal sampling and the big accomplishments realized in leading plants through using "STURTEVANT" automatic method.

Sturtevant Mill Co.

103 Clayton St., Dorchester, Boston, Mass.

floorplates when we worked. Outside we were sliding nearer and nearer to the Isle of Pines.

Again we started. This time on the No. 2 cylinder. Off came that danged scavenge pump, out came the pistons, out came that liner. Back went that liner, back went the pistons, over came the scavenge pump. On went the trombone pipes. The air was correct. Over went the starting levers, and up roared Jessie. My, she really did turn over wonderfully well, and worked better.

On went the blasted indicators. On went the slips. Off came them slips, and, same as before, all showed wonderful conditions. Couldn't be otherwise. We kept our pistons clean. We super-centrifuged our fuel oil. We had everything that could make an engine run.

No Rest for the Weary

Back down below we went. Off came the inspection plates. Out rolled that same bloody gas. It was beautiful the way that white guff sank to our knees, and spread around. Up we tore . . . banged off the trip gear, and madder than hellcats we chewed into the No. 1 cylinder.

Out came the same danged stuff. We retrieved and deceived, conceived and received. Out came that bloody $%&*/? tuppence-happeny liner. Oh, how we sinned that voyage. The atmosphere was luridly painted. The handrails became redhot with shame, aye and even Jessie blushed a rosy pink. The very ship herself must have been ashamed. You should have seen how that danged indicator shook with fear.

No wonder we were stark raving mad. There we were at Barnegat lighthouse, discovering that the No. 1 cylinder liner had busted her rubber dexine rings. This caused leakage of the salt water into the combustion space, and permitted a trickle to slip into the crankcase. Six-hours shifts be d——!

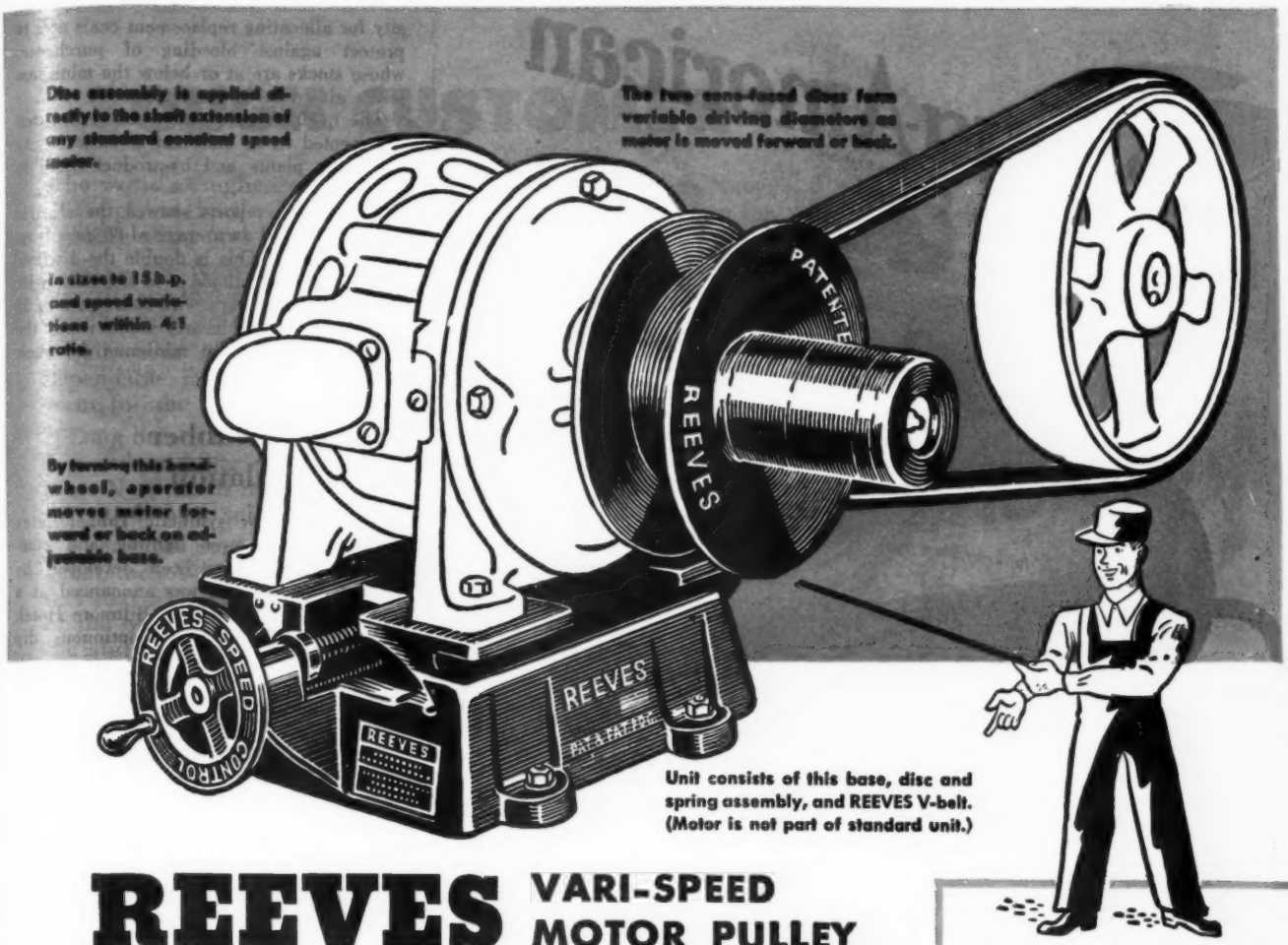
We started Jessie up after we took the pilot aboard. Took indicator cards. Four indicators. Four cards. Oh, yes she was all right. No gas emitted from the crankcase. It was a perfect job. Then we were suddenly jangled to the nerves by the engine telegraph: Stop Engines!

Up we came and wearily staggered along the alleyway to the after well deck, and lo and behold there was Staten Island, and alongside was the Customs.

Up to the East River we went, chugging like a real ship. We felt like genuine engineers as we passed a Cunarder going downstream. We *were* engineers. Them guys on the Cunarder were only hotel flunkies. Turbine reduction indeed! *We had diesels.*

Grand Rapids, Mich.

JOHN M GORRIE

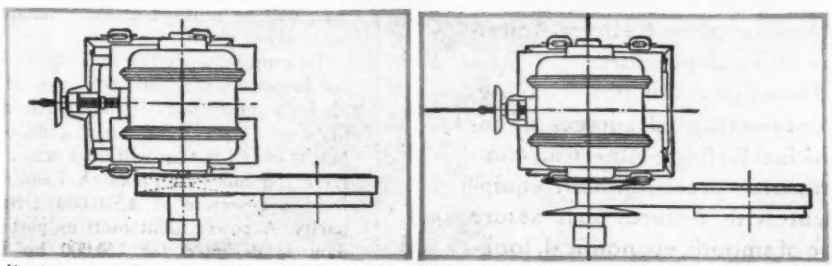

Disc assembly is applied directly to the shaft extension of any standard constant speed motor.
In sizes to 15 h.p. and speed variations within 4:1 ratio.
By turning this handwheel, operator moves motor forward or back on adjustable base.
The two cone-faced discs form variable driving diameters as motor is moved forward or back.
REEVES
REEVES SPEED CONTROL
REEVES
REEVES
PATENTED

Unit consists of this base, disc and spring assembly, and REEVES V-belt. (Motor is not part of standard unit.)

REEVES VARI-SPEED MOTOR PULLEY

Two cone-faced discs are mounted on the standard motor shaft extension. Motor is mounted on adjustable base. Through handwheel control, motor is moved forward or back, varying depth of throat between discs. A REEVES V-belt, running between discs and connected to driven machinery, is kept under constant tension by a compression spring. As depth of throat is varied, V-belt assumes different diameters of contact against discs. Speed adjustments are infinite between the limits, and are made while equipment is running. Constant torque; variable horsepower.

REEVES OPERATING PRINCIPLE THAT GIVES PRODUCTION MACHINES "FIGHTING SPEEDS"



Maximum speed—motor nearest to driven pulley Minimum speed—motor farthest from driven pulley

THESE VITAL ADVANTAGES for War Production

FULL-RANGE SPEED ADJUSTABILITY: Not just steps in speed, but *any* speed—to meet changes in size, shape, periphery or type of work.

NO WASTE IN TIME OR MATERIALS: Speed can be adjusted to skill of workers, to prevent waste and spoilage. Speed changes made without stopping driven machine. Valuable aid to new workers.

OPERATING PRINCIPLE PROVED in 260,000 installations, including use as standard equipment on 1,885 different makes of machines.

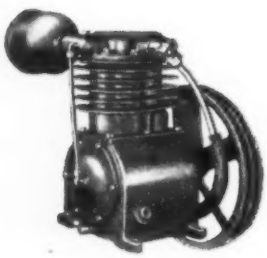
NATION-WIDE ENGINEERING SERVICE: REEVES engineers in 36 leading industrial centers will help you choose the proper unit and apply it correctly.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

REEVES Accurate Variable Speed Control

Kellogg-American
REG. U. S. PAT. OFF.

Individual Compressors
For Individual Jobs



Models from ¼ to 10 H.P., for pressures up to 250 lbs. and displacements 1.5 to 50 cu. ft. per min. Simple compressors, base-mounted motor and engine driven, complete assemblies with tanks, portable or stationary.

• If you are handicapped by an inadequate supply of compressed air for certain production tools or maintenance jobs, due to pipe-line leakage and pressure drop, the answer may be installation of one or more Kellogg-American unit compressors.

Investigate the power-saving, money-saving advantages of individual Kellogg-American compressors—precision-built equipment with features that assure you of smooth, economical, long-life operation.

AIR COMPRESSORS

PAINT SPRAY EQUIPMENT

KELLOGG DIVISION
Rochester 9, N. Y.

AMERICAN Brake Shoe COMPANY

sity for allocating replacement coals and to protect against bleeding of purchasers whose stocks are at or below the minimum levels aimed at in Regulation 10.

The 1,680,000 tons which will be diverted is expected to be sufficient to raise stocks of coking plants and by-product users to 30 days.

Most recent reports showed the electric industry to hold an average of 80 days' supply nationally. This is double the 40-days' normal minimum aimed at in Regulation 10. Other industrial users, with an average of 56 days' supply, hold nearly three times the 20-day Regulation 10 minimum for their class.

Synthetic-Rubber Wire Insulation

Nubun, a new synthetic rubber latex insulation for power lighting and communication-cable has been developed by U. S. Rubber Co, it was announced at a luncheon at the New York Biltmore Hotel, recently. Made by latex continuous dip method, this wire insulation has special advantages where replacement and space are deciding factors. Qualities of the new insulation include flexibility, impermeability to water, laminated construction and perfect centering of the conductor to produce an insulated wire of maximum conductivity and minimum diameter. The synthetic insulation has high dielectric strength and insulation resistance.

Nubun insulation is made from a special modification of buna S synthetic rubber. This compound is low in specific conductive capacity, has good aging qualities because of special anti-oxidants, and will resist severe wear because the rubber particles are not distorted or broken down by milling.

Kentucky Dam To Be Filled Soon

Kentucky Dam, near the mouth of the Tennessee River at Gilbertsville, Ky. will start impounding water this fall to form Kentucky Lake, TVA officials have announced. The electric substation at Murray, Ky., will be finished at approximately the same time.

This project, started in 1938, is one of the largest on the Authority's system. It includes a concrete-gravity and earth-embankment dam, with a crest length of 8650 ft and height of 160 ft, that will back water up the river 150 miles to Pickwick Landing and form a reservoir of 4,570,000 acre-ft capacity. A power plant built as part of the dam is designed for 220,000 hp in five 44,000-hp units at 48-ft head. Static head at the dam will vary between 58.5 and 20 ft. Each vertical-shaft propeller waterwheel with automatic adjustable blades connects to a 35,560-kva 0.9-pf 13.8-kv 60-cycle generator with a Kingsbury thrust bearing below its rotor.

Engineers' Society of Western Pennsylvania will hold its fifth Annual Water Conference, with H M Olson as general chairman, on Monday, Tuesday, Oct 30-31, at the William Penn Hotel, Pittsburgh, Pa.

TOUGH CUSTOMER

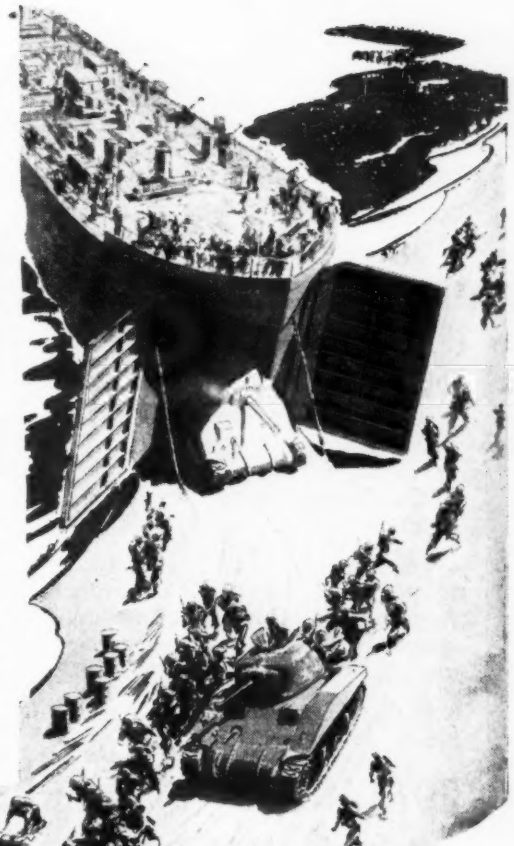
The world's toughest customer . . . that's the United States Navy. Tough in battle — equally tough in buying equipment for fighting ships and men.

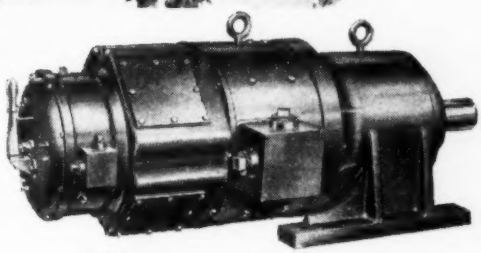
Navy specifications are the strictest ever written. Navy inspectors see that every piece of equipment meets or exceeds those specifications. Navy delivery schedules must be met to the minute.

Star, with more than 30 years' experience building rugged, dependable motors for private industry began building equipment for the Navy during World War I.

Long before Pearl Harbor, Star was assigned the task of designing and building special motors and motor generators to help meet Navy needs in World War II. Tens of thousands have been delivered — all substantially ahead of Navy requirements.

Remember Star's Navy record when you need a motor or motor generator. While the Navy does not endorse any product, the fact that STAR has been a long-time Navy supplier is evidence of the high engineering skill . . . the careful craftsmanship . . . the ability to maintain on-schedule production . . . inherent in this organization. We promise you the same top-quality motors, the same faithful adherence to delivery dates, that we are now giving "the world's toughest customer". Our engineering department is ready now to discuss your motor requirements! Star Electric Motor Co., Bloomfield, N. J.





NOW . . . what's your motor problem?

This Warsaw Elevator motor that lifts and lowers tanks and trucks between top deck and tank deck of an LST is designed to meet Navy demand for compactness, power and ability to stand shocks of shell fire, bombs and mines.

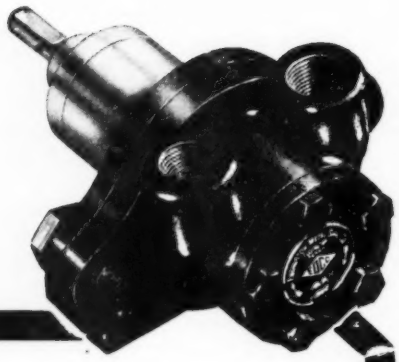
This unit is typical of Star's work for the Navy — and Star's ability to handle any post-war motor problem that may confront you. Star's standard motors — from 1/20th to 200 H.P. will probably satisfy your requirements. But when your specifications call for a "special" to fit mechanical "tight spots", you can enlist Star's know-how in motor design, plus Star's unique welding process, to great advantage.

ARMY E NAVY

STAR MOTORS

POWER PACKAGED AS YOU NEED IT

EDCO ROTARY PUMPS



VANE TYPE
PATENTED CONSTRUCTION

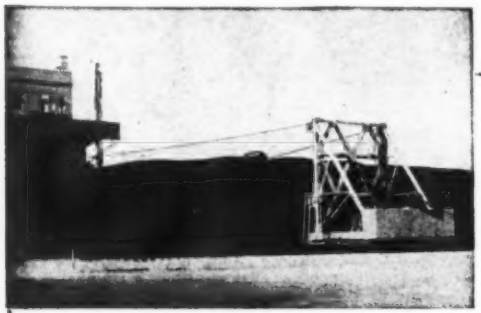
At high or low speeds . . . whether creating a 28" vacuum or developing extremely high pressures . . . the vanes of EDCO Pumps maintain effective spanning position without springs or centrifugal action.

Fuel transfer pumps, coolant pumps and motor-driven assemblies. Furnished in capacities from 2 GPH up, in any required corrosion-resisting material. Operates silently at all speeds. Minimum maintenance required. Used for fuel oils and other fluids of any specific gravity.

FOR COMPLETE DATA . . . write today. Ask for Bulletin 936.

EDDINGTON METAL SPECIALTY CO.

P. O. Box K **Eddington, Pa.**



Build Bigger Stockpiles

the Economical SAUERMAN Way

Pictured above is a stockpile at a 160,000 kw. generating plant where a 7 cu. yd. Sauerman Power Drag Scraper handles an average of one million tons of coal per year, both storing and reclaiming. Typical of all Sauerman installations of large capacity is the self-propelled tall tower shown in the foreground. This tower, governed by remote electric control, provides rapid automatic shifting of the scraper to any part of the area.

SAUERMAN ADVANTAGES:

- Economy of fixed and operating costs
- Simple upkeep
- Adjustable range
- More tons stored on every foot of space
- Makes a homogeneous pile, safe from danger of heating

WITH a Sauerman Scraper you can store a maximum tonnage of coal in a given space and the entire cost will be only a few cents per ton stored and reclaimed.

A Sauerman scraper layers the coal into the pile, avoiding segregation, and thus builds up a high pile that is entirely homogeneous. Chances for spontaneous combustion are reduced to a minimum.

There is a size and type of Sauerman machine for any coal storage project, large or small. Sauerman engineers will be glad to analyze your particular storage problem and submit an estimate of cost of a scraper installation, without obligation.

SAUERMAN BROS., Inc.

562 S. CLINTON ST., CHICAGO 7, ILL.

More Power For Los Angeles

The Los Angeles, California, Department of Water and Power has contracted for the purchase of approximately 268,000,000 kwhr of additional unused energy from the Boulder Dam power plants during the current fiscal year. The purchase is a cut back from the 1,190,000,000 kwhr of energy contracted for by the Defense Plant Corp, released because of production curtailment at the Basic Magnesium plant in Las Vegas, Nevada.

The new 86,300-kw 60-cycle generating unit in Southern California Edison Co's Long Beach steam plant has also been made available. Since 1932, Southern California Edison has operated a 60,000-kw generator in its Long Beach No. 2 plant for the City of Los Angeles. The new agreement also provides for an exchange of electric energy between the two systems through inter-connections in order that maximum service may be obtained from existing electric facilities in the industrial area.

Water Shortage Delays Filling of Norfork Dam

Full scale generation of power at Norfork Dam in Arkansas will be delayed another month or longer because a water shortage prevents filling the reservoir.

Meanwhile, the Norfork 35,000-kw generator is being used as a condenser to maintain voltage on lines through which power is pumped into the Arkansas system from Tennessee Valley Authority. A contract covering this service, and also emergency power supply, is before the Federal Power Commission for approval.

When Norfork goes into commercial operation, it is expected that for the duration most of its energy will be sold to Arkansas Power & Lt Co.

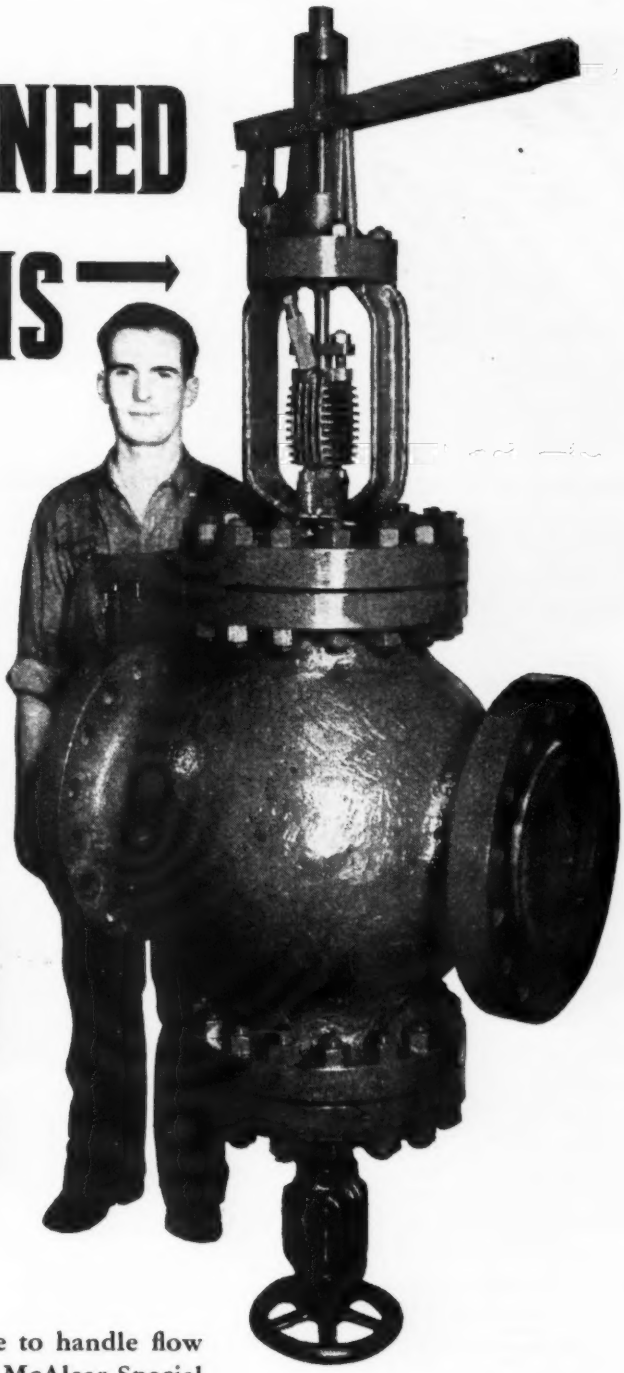
New Virginia Plant Goes on the Line

Virginia Electric and Power Co plant in Chesterfield County went on the line recently after two years of construction delays which put it six months behind schedule. Now carrying 20,000 kw, its full capacity is 50,000 kw—the largest in the Richmond section.

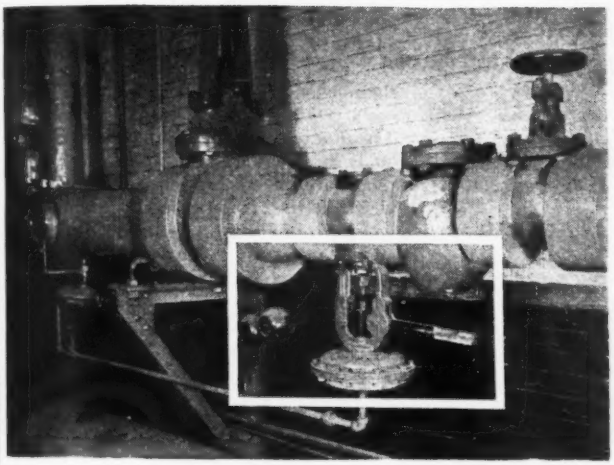
Construction has been in progress since May, 1942, under Stone and Webster Corp. The completed $6,800,000 plant forms part of Virginia Electric and Power Co's system through interconnection with other major power generating plants.

Contract for design and construction of a new high-pressure steam plant, power generating station and other auxiliary work in the expansion program of Union Bag and Paper Corp at Savannah, Ga., has been awarded to Rust Engineering Co of Pittsburgh, Pa., and Birmingham, Ala. Project, valued at approximately $1,500,000, will include alterations and modernizations of the existing steam and power generating facilities.

IF YOU SHOULD NEED A VALVE LIKE THIS →



...or like this



COME TO McALEAR

PERHAPS you never will require a valve to handle flow variations up to 500,000 lbs. steam per hour. The McAlear Special No. 373 Lever Valve shown at the right does just that for a large steel corporation—controlling steam flow from main boiler header to the plant distribution system.

But you *may* need a valve like that shown above—*one* of more than 500 McAlear precision controls for almost every conceivable power or process requirement.

This is No. 175 Pressure Reducing Valve—reducing steam pressure from 50 lbs. to 5 lbs. in the heating system of a large Government Housing Project. It is shown with McAlear No. 528 Strainer, ahead of the valve.

Like *every* McAlear control, regardless of its possible variant uses, these valves were each individually designed for *one* specific application—for *one* set of operating conditions—*precision engineered*, metallurgically and mechanically, to give long, trouble-free service.

For every application—involving control or regulation of temperature, flow or pressure of steam, water, air, gas, chemicals or oil—McAlear either has the control instrument you need, or—will develop a special control for you where *unusual* conditions require it. For descriptive bulletins and catalog, write McAlear Manufacturing Company, 1913 S. Western Avenue, Chicago 8. *Affiliated with: Hanlon-Waters Company, Tulsa; Climax Engineering Company, Clinton, Iowa.*

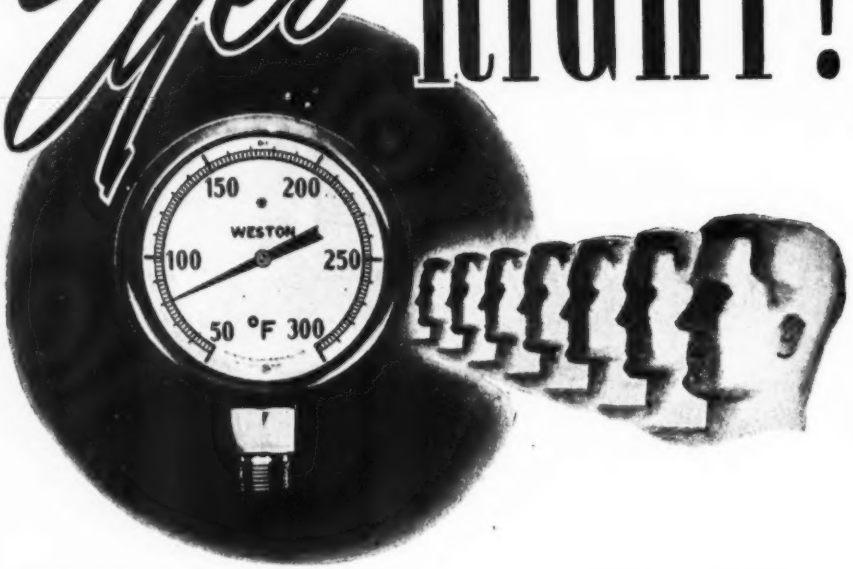
H-W McALEAR controls

PRESSURE · FLOW · LIQUID LEVEL · TEMPERATURE

for STEAM, WATER, AIR, OIL-GAS

WELDED TANKS
BOLTED TANKS
SEPARATORS

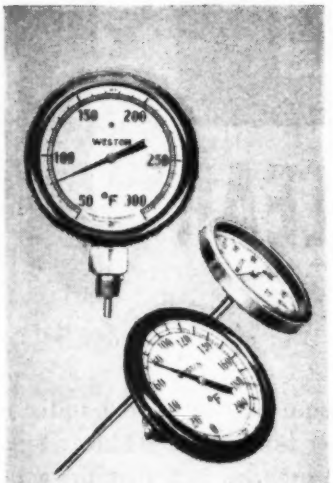
Eyes RIGHT!



WESTON'S ALL-METAL TEMPERATURE PRINCIPLE ASSURES DEPENDABLE READINGS, *OVER LONGER PERIODS!*

The *long-term* dependability of the WESTON thermometer stems from its rugged, all-metal construction. It consists of only a simple, durable all-metal temperature element safely encased in a stainless steel stem. No gases or liquids, no capillary, no complicated mechanical linkages, no fragile parts are employed. Because of this extreme simplicity, and the absence of so many common trouble points, WESTONS maintain their high initial accuracy *over far longer* periods. Thus they provide better protection for processes and equipment, and keep replacement and maintenance costs at a far lower level.

Literature describing these dependable and rugged thermometers, including types, stem lengths, prices, etc., gladly sent on request. WESTON Electrical Instrument Corporation, 679 Frelinghusen Avenue, Newark 5, N. J.



WESTON All-Metal Temperature Gauges are available in sizes and types for most industrial needs . . . as well as in laboratory models with full scale accuracy within ½ of 1%.

WESTON *All Metal* **TEMPERATURE GAUGES**

Brown Reopens Instrument Course

First of the 1944-45 industrial instrument maintenance and repair courses of the training school, Brown Instrument Co, Philadelphia, division of Minneapolis-Honeywell Regulator Co, started Sept. 25. Operation and history of this school from its start in 1935 were the subject of a feature article in July, 1944, POWER.

This fall's classes, according to Earl M Robinson, manager of the company's service division, will be attended largely by personnel from customer plants. Courses will continue until and including Dec. 22. Periods and subject matter are: Sept 25 to Oct 16—millivoltmeter type pyrometers; Oct 17 to Nov 1—mechanical potentiometer pyrometers; Nov 2 to 9—continuous-balance electronic potentiometer; Nov 10 to 20—electric-operated automatic control; Nov 21 to 30—flowmeters; Dec 1 to 8—thermometers, pressure gages and hygrometers; Dec 11 to 13—air-operated automatic control; Dec 14 to 23—CO_2, analygraph, resistance thermometers and tachometers.

The Factory of the Future is a research study by H K Ferguson Co. Included in the report are the coming importance of the air view of the factory, night architecture, benefits of parkway approach to a plant, added personnel conveniences, interior factory treatment, basic layouts for typical mfg plants, boiler-house improvements. In discussing the latter, the report considers smoke one of the principal causes for the dreary, dirty industrial fringe around most cities. It predicts elimination of the boiler-house as we know it, and in its place a clean and economical source of power and heat.

CURRENT AWARDS

Maritime "M" Pennant and Victory Fleet Flag, were presented to the three plants of Farrel-Birmingham Co, Inc. at Ansonia, Conn., Derby, Conn. and Buffalo, N. Y. This company also holds a Navy "E" with four stars.

Army-Navy "E" pennant with four stars has been awarded to the Handy & Harman plant, and another to Buffalo Pumps, Inc.

Two-star Army-Navy "E" burgee flies over the Brown Instrument Co, Philadelphia, precision industrial instrument division of Minneapolis-Honeywell Regulator Co.

Army-Navy "E" award has been announced by the S Morgan Smith Co.

"M" flag with three gold stars was won by the employees of Jenkins Bros.

The Ordnance Distinguished Service Award was granted to the Battelle Institute, research organization. The diploma bears the seal of the War Department, and is awarded in recognition of scientific and engineering achievement.

A blue and gold merit flag, emblematic of high efficiency in organization and training, was awarded the Auxiliary Military Police Force of the Bureau of Mines helium plant at Exell, Texas, by the Army, for safeguarding a vital war production plant.

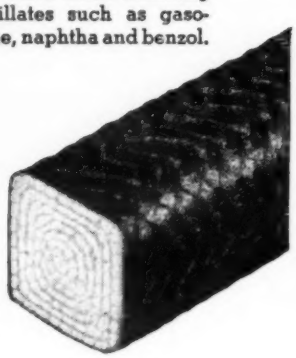
"HERE, ROSIE, THE RIVETER
is one of the reasons
you can do your job so well"
Scotch tape holds a row of rivets in place for you, doesn't it, Rosie . . . multiplies your production on your vital job? Well, yours is just one of the thousands of war or civilian uses for such tape.
Obviously, tape production mustn't be interrupted. Moreover, quality must remain uniform.
And that's where Bowser Exact Liquid Control comes in. Years ago, one of America's largest producers of industrial tape installed Bowser Meters to measure precisely the various ingredients that give tape adhesive the proper consistency. Then other Bowser Meters measure the flow of adhesive on the backings of cellophane, paper or other materials.
But there was another tough problem—rust and dust in the adhesive solvent caused the backing sheets to tear as they passed through the applicator machine. There were frequent costly shutdowns. How were they licked? By a Bowser Filter, which clears the solvent.
Visit other departments of this company and you'll find Bowser Lubrication and Filtration units, Fuel Oil Meters, etc., doing work that couldn't be done as well, if at all, by any other method.
In the Power industry, still other types of Bowser Liquid Control equipment are giving equally outstanding service—turbine oil conditioners, filters and force feed lubricators, for instance.
Operating tests, conducted by impartial experts, have shown that oil, if kept perfectly clean, remains as good as new. Bowser Pressure Filters, working under severe power plant operating conditions, have demonstrated their ability to keep oil clean and efficient much longer, thus prolonging the life of the equipment and saving money. BOWSER, INC., Fort Wayne 2, Indiana.
BOWSER
ESTABLISHED 1885
THE NAME THAT MEANS EXACT CONTROL OF LIQUIDS
Not only has Bowser's war production earned the Army-Navy E . . . Bowser equipment has helped earn it for scores of other companies.
BUY WAR BONDS

BELMONT PACKINGS

FOR GASOLINE SERVICE

← Belmont 6100

For rod and valve stems handling volatile distillates such as gasoline, kerosene, naphtha and benzol.



FOR HOT OIL SERVICE

Belmont 189 →

For rods and plungers handling hot or cold oil—all temperatures.

For OIL

PACKINGS are important in every plant production program. They keep the machines of industry turning—help speed from assembly lines America's weapons of war.

AND . . . now, when equipment must stand the strain of 24-hour-a-day operations—it's vitally important that just the right packings be selected for every job.

Above are two of the many Belmont Packings especially made for petroleum services. Both 6100 and 189 are made from asbestos yarn, braided and treated with suitable lubricants for maximum operating efficiency.

Any Belmont distributor (they are located in every large industrial center) will be glad to offer suggestions on your requirements. Or write on your company letterhead for a copy of the Belmont Packings Catalog displaying the complete Belmont Line.

THERE'S A BELMONT PACKING FOR EVERY SERVICE

Steam, Water, Oil, Gas, Air, Acids, Alkalies, Ammonia

Rings, Spirals, Coils, Reels, Spools, Sheets, Gaskets.

THE BELMONT PACKING & RUBBER COMPANY

BUTLER AND SEPVIVA STREETS • PHILADELPHIA 37, PA.

Six Subcommittees on Corrosion Appointed

American Coordinating Committee on Corrosion, at its sixth annual meeting at the Waldorf-Astoria Hotel, New York, elected Frank L LaQue, of the development and research div of the International Nickel Co as chairman for the current year. Dr. George H Young, of the Mellon Inst of Industrial Research, was named vice-chairman; and George W Seagren, also of Mellon Inst was elected secy-treas. Committee headquarters are at 4400 Fifth Ave, Pittsburgh, Pa.

The Committee was organized to serve as clearing house and coordinating agency for information on experience and work in the field of corrosion and corrosion prevention; also as a medium through which individual workers may contact other investigators here and abroad in specific fields of corrosion work.

Six sub-committees have been activated: (1) To coordinate studies on underwater paints; (2) To cooperate with British Admiralty Marine Corrosion Committee; (3) To examine and approve applications for grants-in-aid from the research fund offered by American Society for Metals for the support of fundamental research on corrosion; (4) To standardize corrosion test materials; (5) To standardize corrosion terms and symbols; (6) To advise the Navy's Bureau of Ships on special problems upon request.

New WPB Utilities Order

Simplified construction procedures for electric, water, gas and central steam-heat producers have been made applicable retroactively to construction authorizations issued prior to June 10. Utilities Order U-1, Direction 2, dated July 18, 1944 supplants contrary provisions which may appear on the face of any WPB-2774 authorizations.

Under new procedure, the affected utilities are authorized:

1. To use the abbreviated allotment number U-2 instead of specific quarterly allotments previously issued, except for allotments in excess of 100 tons of steel or 10,000 pounds (25,000 pounds in the case of telephone and telegraph companies) of copper wire and cable. Electric, water, gas and central steam-heat producers may use the U-2 symbol to obtain only 5,000 pounds of aluminum wire and cable for individual jobs. Specific allotments for these three materials in excess of the quantities indicated remain in force.

2. To use and purchase larger quantities of materials and equipment than were authorized on approved applications, if these are of same kind, type, size and capacity as were approved, and if they are required for the job. In the case of electric, water, gas or central steam-heat producers, however, this does not apply to transformers, poles, crossarms and meters, the use and purchase of which are limited to quantities specifically authorized on the previously approved application.

Nothing in the procedure makes it necessary for utilities to make any change in orders which they have already placed.

This VALVE is worth Looking Into!

LOOK into this sturdy OIC Cast Steel Valve and get the true inside story of the many benefits to be derived from its use.

Look at its sturdy hand wheel and the long thread engagement between yoke sleeve and stem which means low thread bearing pressure.

Look at its two-piece yoke and pressure-lubricated yoke sleeve.

Look at the self-aligning two-piece gland assembly, with gland and follower held together by self-locking lugs and raised together for quicker, easier repacking under pressure.

Look at the safe, convenient gland eye-bolts that swing down out of the way during repacking and are never lost.

Look at the extra deep stuffing box with metal-core braided asbestos packing rings for an efficient seal and less frequent maintenance.

Look at the deep condensing chamber, assuring longer packing life.

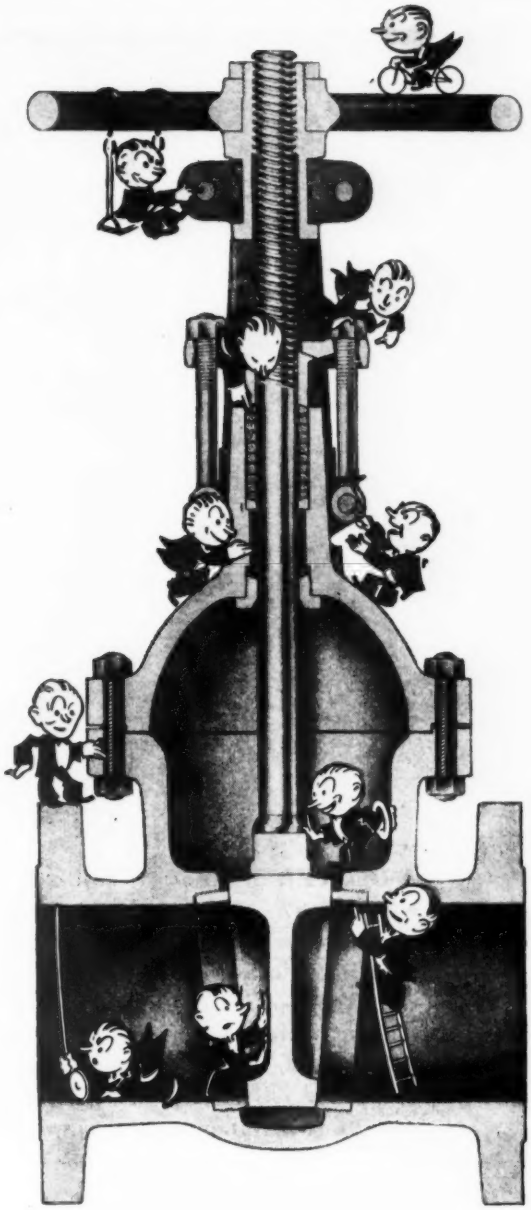
Look at the full-threaded bonnet stud bolts especially designed for maximum tension loads under specified operating conditions.

Look at the rugged T-slot connection between stem and wedge, to prevent lateral strains on stem.

Look at the barrel-type seat rings for positive seating.

Look at the heavy I-beam type solid wedge.

Look at the straight-through streamlined ports.



OIC Cast Steel Valves . . . Gates . . . Globes . . . Angles . . . Checks . . . are available in the 150 and 300-pound pressure classes, with screwed, flanged or butt welding joints.

There is an OIC Distributor near you who is ready to demonstrate to you the many superior features of OIC Cast Steel Valves. Call him or write to us for full details.

ARMY E NAVY

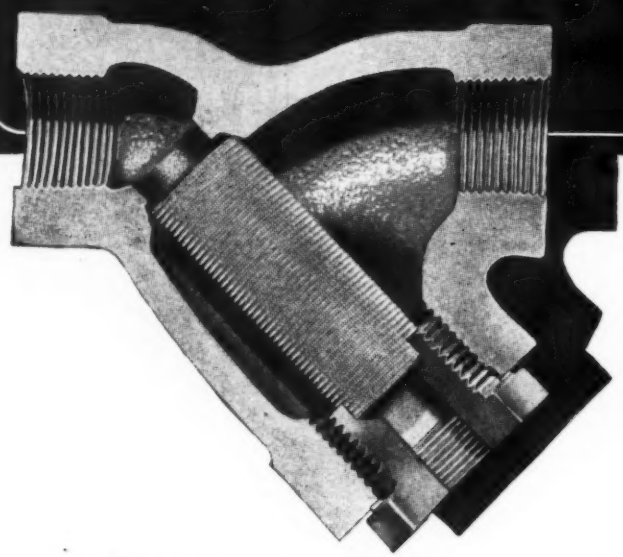
OIC

THE OHIO INJECTOR COMPANY

WADSWORTH, OHIO

Quality Leaders in Valve Manufacture Since 1883

It says
"STOP" to Solids—
"GO" to Fluids



A BETTER Strainer to "police your pipelines"

- **FIRST**—*The Screen*, a high-grade woven Monel wire basket that catches solids—lets condensate, oil or other fluids flow freely.
- **SECOND**—*Finish*. Cadmium plated inside and out for protection against corrosion.
- **THIRD**—*Easily Cleaned*. Blow-off bushing made for easy removal. Bushing and Screen come out together. Screen automatically aligns on reassembly.
- THOUSANDS IN SERVICE—Sold by over 100 Mill Supply Houses.

6 sizes from ½" to 2" for pressures up to 600 lb. Reasonably priced. See your supply house or write for Bulletin S-200.

YARNALL-WARING COMPANY
100 Mermaid Ave. PHILADELPHIA 18, PA.

YARWAY STRAINERS

Power Show To Have Reconversion Slant

A bright outlook is held for the 16th National Exposition of Power and Mechanical Engineering, which was announced last month, to be held from November 27th to December 2nd at Madison Square Garden, New York.

Upsurge of recent events in Europe has sharpened the need for power supplies for the arsenal of the Allies, while stimulating the demand for accelerated progress toward industrial reconversion.

The Power Show will feature apparatus for production, control, distribution and transmission of heat and power. There will also be displays of metals and other materials especially adapted to plant and mill construction; alteration and maintenance, materials handling equipment, engineering specialties and laboratory equipment for research and production control.

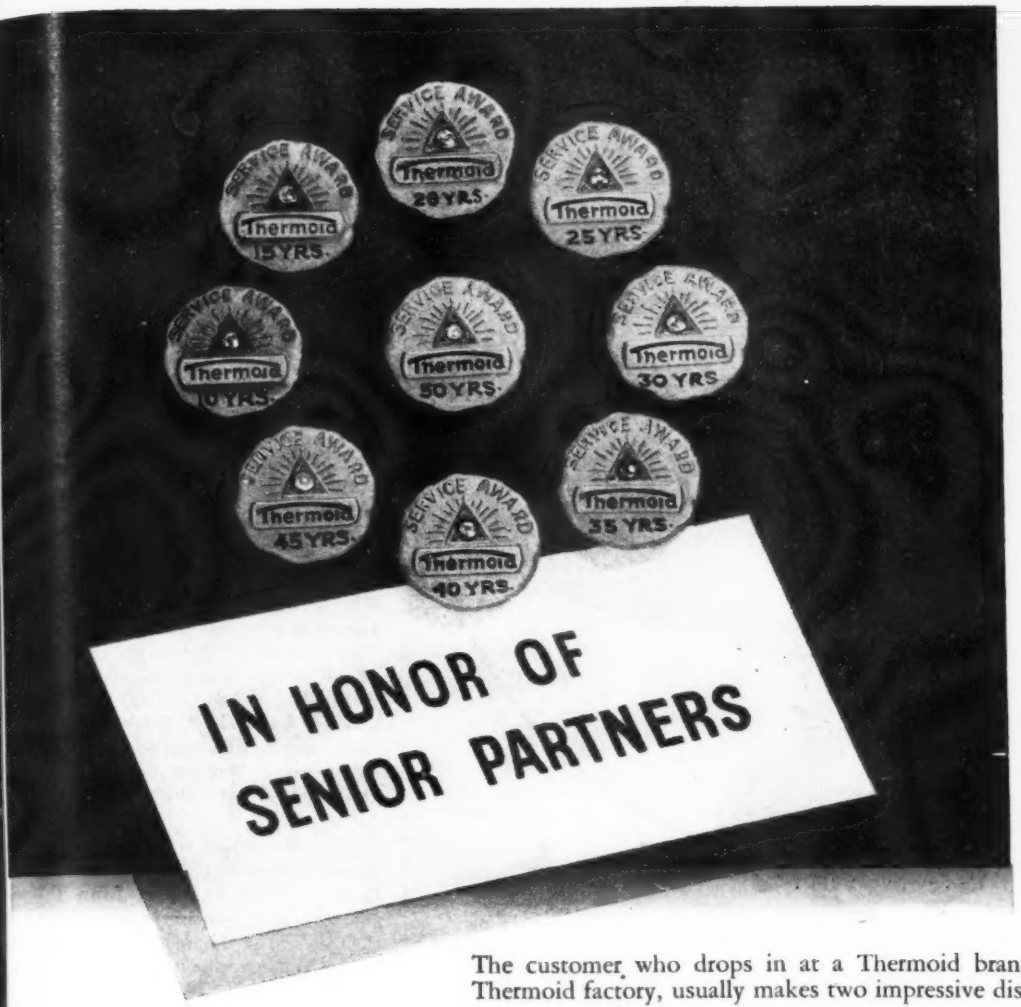
Power plant equipment, well represented on the exhibitors' list, includes many lines of materials, supplies, equipment and instruments which afford the means for converting existing power plants to serve new and larger demands with better economy. Taken as a group, this class includes a substantial proportion of those who, by December, should be able to supply customers or schedule firm orders promptly. Machine tools, instruments and tool room equipment constitute another group of exhibits already well filled, and many innovations based on experience of war production are promised.

The exhibit area has been enlarged over that of previous years; and Charles F Roth, president of the International Exposition Co and manager of the show, predicts an exceptional buying interest. Attendance is by invitation and registration only, there being no admission of the general public.

A diesel-teaching laboratory—most modern and complete in the world—was dedicated recently at North Carolina State College. The $200,000 building houses diesel installations from leading manufacturers, including a Cooper-Bessemer GSB direct-reversing 8-cylinder unit, typical of many diesels built for the Navy and other branches of our military services.

Rear Admiral E L Cochrane, U. S. Navy, chief of the Bureau of Ships, as the principal speaker at the dedication said, "During the 10-year period from 1932 the extent of diesel installations in Naval vessels of all types was stepped up from a total of approximately 150,000 hp to a total of 10,000,000 hp in 1942. By the end of 1944 the total installations will exceed 30,000,000 hp by a substantial margin."

West Penn Power Co will install a 65,000-kw generating unit in its Springdale station on the Allegheny River, 17 miles above Pittsburgh. This will increase the station's capacity to about 300,000 kw and make it one of the largest in western Pa. The new unit includes an 800,000-lb-per-hr 1250-psi 925-F boiler, supplying steam to a 3600-rpm turbine. No additional transmission lines or substations will be needed to take care of the increased station or system load. The additional 275,000 tons of coal per year needed will come from the Springdale mine.



The customer who drops in at a Thermoid branch office, or visits a Thermoid factory, usually makes two impressive discoveries:

***FIRST**—the sincerity of everyone's interest in his call; and*
***SECOND**—the number of persons he sees wearing emblems that resemble the ones pictured here.*

Actually, these phenomena are inseparable twins. Both are born of a policy instituted by Thermoid many years ago . . . a policy of company recognitions and rewards that encourage each employee to see himself as an active partner in the one, important business of advancing the common welfare of himself, his employer, his fellow workers and every Thermoid customer. Today, as just one result of that policy, over 300 Thermoid men and women proudly wear service medals representing from 10 years to 50 years of continuous employment with us.

The sense of proprietorship and personal responsibility felt by Thermoid employees is among our most valued assets. It marks a spirit of co-operation that gets things done—and done *right* . . . the spirit that causes Thermoid customers to say: "It's good business to do business with Thermoid."

Thermoid Rubber

DIVISION OF THERMOID COMPANY

TRENTON, NEW JERSEY

DON'T PUT IT OFF 'TIL TOMORROW—
Buy More War Bonds Today!

THE THERMOID LINE INCLUDES: **TRANSMISSION BELTING • F. H. P. AND MULTIPLE V-BELTS AND DRIVES • CONVEYOR BELTING • ELEVATOR BELTING • WRAPPED AND MOLDED HOSE • SHEET PACKINGS • INDUSTRIAL BRAKE LININGS AND FRICTION PRODUCTS • MOLDED HARD RUBBER AND PLASTIC PRODUCTS.**

It's Good Business to Do Business with Thermoid

CLOSE CONTROL WITH ACCURATE REGULATION

Single seated, balanced, lever and weight loaded, diaphragm valves—also balanced lever valves—for low to high pressures. Same design in double-seated, semi-balanced construction.

Semi-balanced, double-seated lever valves for low and high pressures. Seats beveled and ground in, eliminating sticking and leaking of pistons.

A small (three sizes) spring balanced valve of exceptional merit for standard services on water, steam or air.

Double seated, unbalanced type, back pressure release valve. Can be supplied to suit various pressures without excessive weighting.

Pilot operated valves, with five designs of Pilot Control Valves, to meet various operating pressure requirements.

● If you have a problem of close control with accurate regulation, use Stickle Valves. Stickle Valves were developed especially to meet the requirements of complicated pressure regulation—for service where exacting control is necessary—to obtain the extreme sensitivity for automatic control with fractional variations in pressures. Made in single-seated and double-seated series, balanced and semi-balanced in sizes small to large, to meet most industrial requirements. Ask for Bulletin Nos. 235 and 435 for full descriptions and data on complete line.

Stickle

STEAM SPECIALTIES COMPANY

2265 VALLEY AVENUE • INDIANAPOLIS, INDIANA

SPECIALIZING FOR 40 YEARS IN REDUCING THE COST OF STEAM

APPOINTMENTS

Westinghouse Electric & Mfg Co reports that **Frank E Bodine,** formerly manager of the Salt Lake City office, has been transferred to San Francisco as manager of that office. **Maurice H Hobbs** is manager, engineering department of Westinghouse switchgear and control division: in the switchboard engineering department, **Charles P West** is manager and **Wilbur C Fulton,** section engineer.

Manning, Maxwell & Moore appoints **E M Dunlap** manager of distributor sales. **L T Willison** is manager of cold finished sales of **Jones & Laughlin Steel Corp** in addition to being manager of ordnance sales. **Hagan Corp** names **M J Boho** assistant general manager of sales.

Link-Belt Co, Pacific division, promotes **Fred A Koepf** to district manager for northwest Pacific division with headquarters at Seattle, Wash., and **George T Lundquist** to assistant manager at Los Angeles. **Hunter Michaels,** sales manager of railway steel spring division and **Hugh Corrough,** division manager of Alco Products of **American Locomotive Co** have been named directors of their divisions. **Progressive Welder Co** appoints **E J DelVecchio** field sales manager.

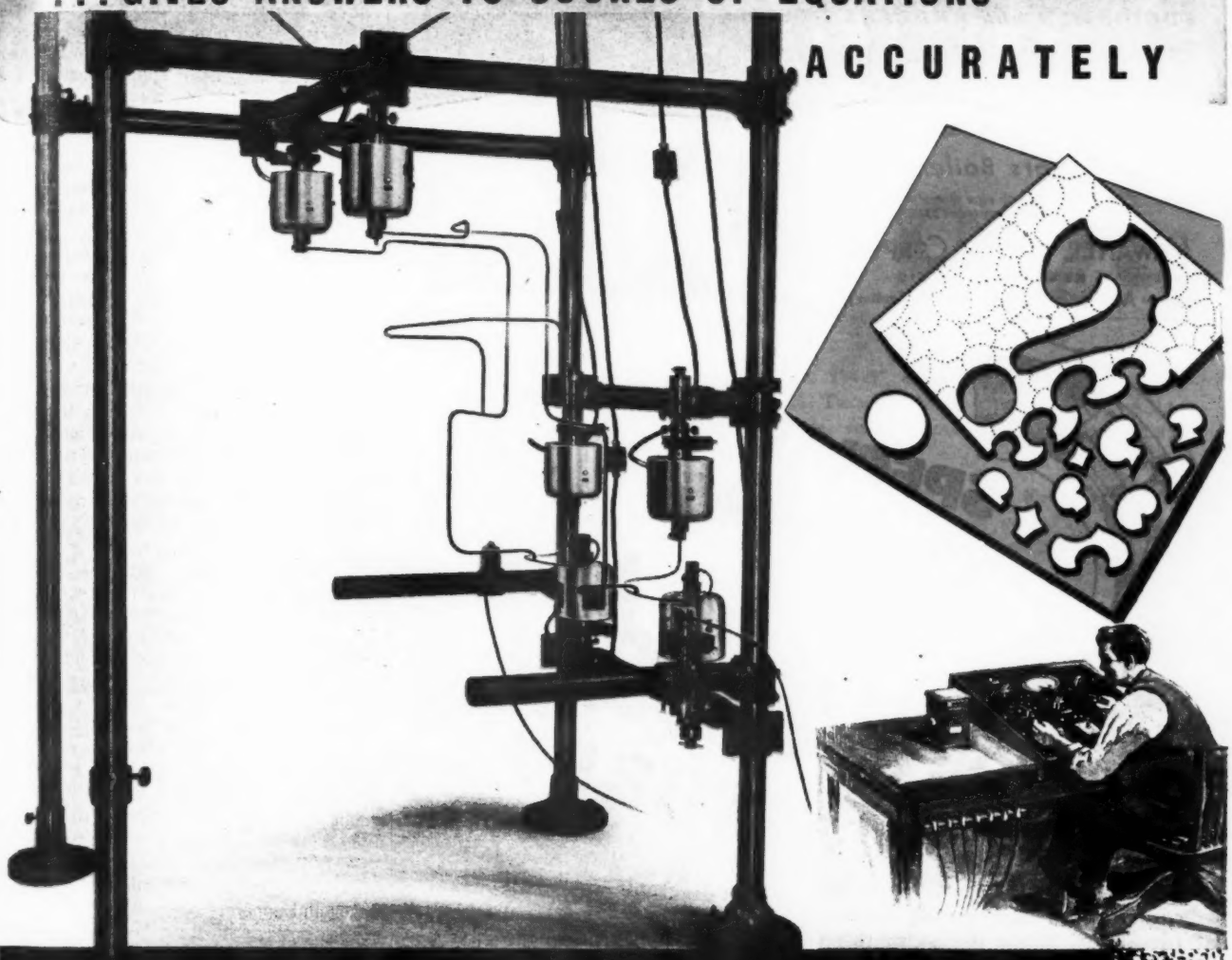
Robert E Dillon, vice-president and assistant general manager of **Boston Edison Co** is also chief engineer; **John T Ward,** another vice-president is now director of electric and steam operations; **Leavitt L Edgar,** vice-president in charge of purchasing will also be responsible for fuel procurement; and **Dale E Washburn** is power sales manager.

Bituminous Coal Research, Inc appoints **Elmer R Kaiser** assistant director of research for an expanded technical program, to work with **Dr H J Rose,** recently-appointed director. **Carl Christiansen** is on the engineering staff of **John C Dolph Co.** New assistant engineer of **General Electric Co's** general engineering laboratory is **C W LaPierre,** formerly in charge of the electro-mechanical section. **H W Christoffers** with **L T Dupree** and **R B Schneider** are on the staff of **Arthur D Little, Inc.** Newly-established consulting engineering department of **C H Sprague & Son Co** is headed by **Lawrence E Mulloney.**

Jones & Laughlin Steel Corp announces that **Adam J Hazlett** has been elected vice-president, in charge of sales, and John W. Reavis a director. **Monsanto Chemical Co** promotes **Walter P Konrad** from the phosphate sales dept in St Louis to branch manager of the phosphate division sales dept in Chicago.

Weston Electrical Instrument Corp's engineering department announces the following personnel changes: **John H Miller** is promoted to chief electrical engineer; **Frank X Lamb** is made assistant chief electrical engineer; **Karl M Lederer** is now assistant director of research; and **W N Goodwin, Jr,** continues as vice-

DETERMINING MOMENTS AND FORCES ELECTRICALLY ...GIVES ANSWERS TO SCORES OF EQUATIONS ACCURATELY



KELLOGG PIPING ENGINEERS CAN SUPPLY ACCURATE ANSWERS TO AS MANY AS 72 SIMULTANEOUS EQUATIONS—COVERING UP TO 12 POINTS OF FIXATION, WITH THIS APPARATUS!

The super-sensitive instruments which make this possible were designed and are used exclusively in the Kellogg Engineering Department for the sole benefit of Kellogg clients. By their use the most complicated design problems of high pressure, high temperature piping systems are solved accurately and quickly—an exact scientific analysis of the end reactions is arrived at.

There is no guess work, no possibility of error or delay in figuring, when these sensitive Kellogg instruments are used. They reduce figuring time, assure absolutely accurate results and thus save our clients time and money by giving them mechanically and scientifically correct piping systems for their individual needs as well as often substantially reducing the quantity of vital piping material

KELLOGG

THE M. W. KELLOGG COMPANY
Jersey City, N. J. • 225 Broadway, New York 7, N.Y.
Representatives:
LOS ANGELES: 609 SOUTH GRAND • TULSA: PHILTOWER BLDG.

M KELLOGG W

M★★★

"Masterflex" Prefabricated Piping Systems • "Masterweld" pressure vessels for Power, Refinery and Chemical Industries. Heat Exchangers. Pyrolytic and Catalytic Cracking Units, Hydroforming, Reforming, Dehydrogenation, Alkylation, Desulphurization. Thermal and Catalytic Polymerization Units • JUIK Processes for Lubricating Oil Plants. Plastic Refractories • Radial Brick Chimneys.

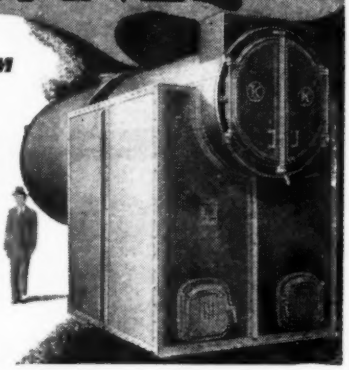
HI-TEST KEWANEE

FOR POWER and PROCESS STEAM

6 Sizes . . . 50 to 150 H.P. . . . 125 to 150 lbs. W.P. A quick steaming all-welded portable boiler with refractory lined firebox and 2-pass tubes to save fuel.

75 Years Boilermakers

For 6" scale with pipe diameter marking, write Department 89-K10.



KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Division of AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

SPECIAL CLEANERS FOR Curved TUBES

All the requirements for cleaning curved tubes successfully are fulfilled by the Wilson E.C.T. Series Air Motor. It has the extra power and high torque necessary to remove heavy deposits without stalling; saving time, money and labor in tube cleaning

Its small diameter, short length, and special armored flexible hose minimize possibility of jamming. When used with a universal joint, and radial expansion cutter heads or cleaners it will negotiate extremely short-radius bends. An exclusive valve design which makes full use of air with minimum back pressure, leakage and friction, together with its six-blade construction, provide smooth power and prevent stalling.

Consult the Thomas C. Wilson engineering staff on any difficult tube cleaning problem—or write for complete bulletin.

MODERN TUBE-CLEANERS FOR THE PROBLEMS OF TODAY

wilson
AIR TUBE CLEANERS EXCLUSIVELY

THOMAS C. WILSON Inc.
21-11 44th AVENUE, LONG ISLAND CITY 1, NEW YORK

president in charge of research and engineering and as consultant in engineering matters in general. **Pittsburgh Piping & Equipment Co** announces **Harry Zinkil** as district manager with offices in Detroit. **R C Wingerter** of the **Timkin Roller Bearing Co** is now assistant chief engineer for their industrial division. **Jas. P Marsh Corp** announces the appointment of **R S Gaisford** as manager of their export department in New York.

C B Campbell is engineering manager of the steam division of **Westinghouse Electric & Mfg Co,** and **J S Newton** is assistant manager of engineering. Westinghouse also announces the appointment of **C C Franck** as manager of land turbine engineering in the steam division. **A G Bailey** becomes deputy chairman of the **Petroleum and Natural Gas Conservation Board** of Alberta, Canada, with headquarters in Calgary. **Frank C Angle**, manager of Allis-Chalmers sales activities in the Pacific region, is appointed manager of all Allis-Chalmers field sales offices of the general machinery division and their operations, continuing supervision of the Pacific region.

Roscoe H Smith is head of **Reliance Electric & Engrg Co's** newly-established sales promotion department; **Kenneth F Ertell,** assistant advertising manager; **Richard A Geuder,** manager of applied engineering, specializing in motor drive problems of the metal industry, and assisted by **John L Van Nort** and **William C Madsen;** and **C V Putnam** and **Paul W Arnold** continue as secretary of the company and manager of machinery design applications respectively.

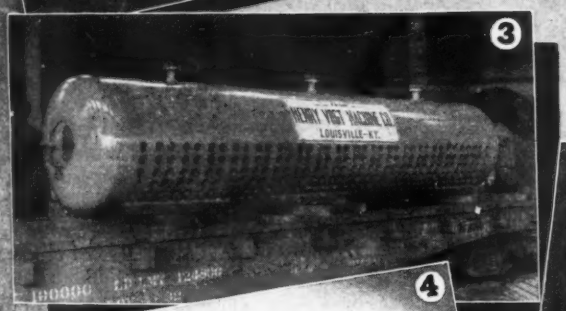
Eagle-Picher Sales Co promotes **Douglas Via** to industrial insulation sales manager and appoints **Andrew L Harris** manager of sales promotion. **Wilbur E Geiser,** who has been with the WPB valve and fittings section, returns to his post as manager of the Philadelphia office of **Tube Turns, Inc,** and the Los Angeles office of the Tube Turns company reopens in the Van Nuys Bldg with **James H Withers** in charge. **The Foxboro Co** adds **Paul Torre** to their sales engineers staff to cover the New England territory.

Charles L Saunders resigns as branch chief of WPB Office of Civilian Requirements to become **Wheelco Instruments Co** vice-president. **E E LeVan** is president of **Haynes Stellite Co,** a unit of Union Carbide and Carbon Corp. **John Waldron Corp** elects **B R Newcomb** president. **Joseph S Bennett** is vice-president of **American Engineering Co.** Announcement from **J O Ross Engineering Corp** lists the following changes: **S W Fletcher,** former executive vice-president is president of the company, continuing with headquarters in New York; **A E Montgomery** is vice-president with headquarters in Chicago; **H G Rappolt** and **F W Partsch** are vice-presidents; **J A Ronder** is treasurer and **R W Grott,** secretary.

Devenco Inc, a new company with offices at 150 Broadway, New York 7, N. Y., renders development engineering services.

A.P.I.—A.S.M.E. and A.S.M.E. CODES • CARBON STEEL AND SPECIAL STEEL

WELDED PRODUCTS by Vogt



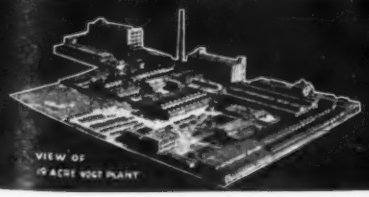
1 - 4'—0" dia. x 7'—6" dia. x 82'—5" high Stabilizer Tower for a Texas Refinery. Fabricated to A.P.I.-A.S.M.E. Code, stress relieved and X-rayed. 250# working pressure.

2 - Heat Exchangers, for an Eastern Refinery, on the testing floor. Units have fusion welded Monel Metal shells and were built to customer's specifications.

3 - 48" dia. x 22'—6" long mud drum for a Vogt Water Tube Boiler designed to operate at 450# S.W.P. Fusion welded to A.S.M.E. Boiler Code.

4 - Battery of Absorption Columns in a Western Refinery. Units are 33" dia. x 41'—0" high and were stress relieved after welding.

5 - 400 KV Industrial X-ray unit in our plate welding department. Exographs of welded seams can be quickly made because of the special motor operated rolls and traveling carriages which are adjustable to vessels of any size.

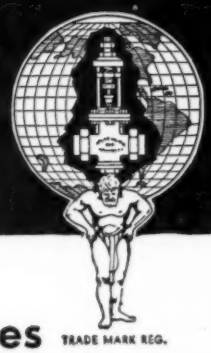


HENRY VOGT MACHINE CO.
Incorporated
LOUISVILLE, KENTUCKY
BRANCH OFFICES: NEW YORK · PHILADELPHIA · CLEVELAND · CHICAGO · DALLAS

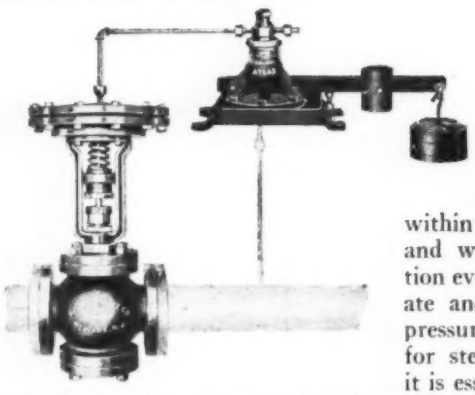
ATLAS

Super-Sensitive

PRESSURE REGULATORS



maintain controlled pressures TRADE MARK REG. **without variation – regardless of fluctuations in demand or varying initial pressures**



This ATLAS Super-Sensitive Regulator is particularly adapted to service where pressures must be maintained within fractions of one pound and without perceptible variation even where demands fluctuate and widely varying initial pressures occur. It is suitable for steam, air, gas, etc. where it is essential to maintain a constant reduced pressure in heating mains, vats, cookers, retorts, etc. It may also be applied as an altitude regulator to maintain constant level in open tanks, or as a pump governor to assure constant pump discharge pressure.

The scope of applications of this ATLAS Regulator is almost unlimited in pressure regulation. It will accurately regulate at any pressure between the initial pressure and atmosphere in one stage, operating control valves from ½" to 6."

Write for Bulletin No. 1B
Giving Complete Details

No. 801—for reduced pressures 2 to 15 lb.
No. 801-8—for reduced pressures 0 to 5 lb.
No. 802—for reduced pressures 15 to 150 lb.
Sizes ½", ¾", 1", 1¼", 1½", 2", 2½", 3", 4", 5", 6".

Check the items below on which you want information and mail to us with your name, firm name and address.

PRINCIPAL ATLAS PRODUCTS

- ☐ Super-sensitive Pressure Regulators
- ☐ Other Pressure Regulators
- ☐ Damper Regulators
- ☐ Temperature Regulators
- ☐ Reducing Valves
- ☐ Exhaust Control Systems
- ☐ CAMPBELL Boiler Feed Water Regulators
- ☐ Pump Governors
- ☐ Float Valves
- ☐ Oil Control Cocks
- ☐ Humidity Controllers
- ☐ Thermostats
- ☐ Balanced Valves
- ☐ Control Valves

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

Specialists in Regulation for Nearly a Half Century

289 South St., Newark 5, N. J.

Representatives in Principal Cities

Engineering Equipment Co now represents **Yeomans Bros Co** in the Cincinnati area which has been enlarged to include Dearborn County in Indiana and the northern tier of Kentucky counties facing southwestern Ohio. **Stock Engineering Co's** main office is now at 715 Hanna Bldg. Cleveland, Ohio; and **A A Betts**, 2919 Kling Ave, Cincinnati, is sales representative. **American Standards Association** moves to Grand Central Terminal Office Bldg, 70 E 45th St, New York 17, N. Y.

John W Boyer, chief, alcohol and solvents branch of the chemical bureau, **War Production Board** resigned to establish himself in Washington as a consultant to the chemicals industry. **Donald W McGill** is manager, machinery electrification section of **Westinghouse Electric & Mfg Co** succeeding **L F A Mitchell** who has returned to the **Canadian Westinghouse Co** as assistant to the vice-president. **Whiting Corp** announces the appointment of the **Cardinal Supply & Mfg Co,** 427 Sunderland Bldg, Omaha, Neb. as its exclusive sales representative in the Omaha territory. **Stanley W MacKenzie** is director of purchases for **United States Rubber Co,** succeeding **George M Tisdale,** who was elected a vice-president and member of the company's executive committee.

Westinghouse Elec Elevator Co has been elected to membership in the Air Conditioning and Refrigerating Machinery Association.

OBITUARIES

Wirt S Quigley, president of The Quigley Co, Inc, died July 16.

Edgar H Bristol, 73, president and founder of The Foxboro Co, died in Falmouth Heights Massachusetts July 24.

Dr Frank Jerome Tone, 76, chairman of the board of directors of The Carborundum Co, died at his home July 26 after a long illness.

John R. Rehbaum, 69, chief stationary engineer at the William Hengerer Co. died July 26.

Capt Doane S Nickerson, 59, engineer of the Gloucester (Mass.) Electric Co. died at Beverly, Mass. July 27.

Edward Bausch, 89, chairman of the board of the Bausch & Lomb Optical Co. died July 30, after an illness of more than two years.

Shelby M Jett, 55, secretary and a director of The B F Goodrich Co died Aug 9 when stricken with a heart attack aboard an airlines plane.

William B. Marvin, 64, secretary of Farrel-Birmingham, Inc, died Aug 13 after a short illness.

Albert H Killinger, 50, vice-president and director of Laclede-Christy Clay Products Co, died August 18, after a brief illness.

Paul Stewart, Sr, died Aug. 21. Paul Stewart & Co, which he started in 1910, dealt in heavy power-plant apparatus and was engaged by several utility groups in the sale of surplus equipment.

ADAMANT
FIRE BRICK CEMENT

BECAUSE IT'S *AIR-FLOATED*

"Air Floating"—a process in the manufacture of Adamant Fire Brick Cement, eliminates the larger, coarser particles and leaves only the basis for a finer, *smoother* cement.

The resulting exceptional, uniform *smoothness* of Adamant permits the highly desirable thin joints which literally weld the brick together.

Furthermore Adamant is a cement of unusually high bonding strength. Laboratory tests made by a leading technical institute show that it possesses a bonding strength of 800 pounds per square inch at room temperature and 1270 pounds to the square inch at 2600° F. It has a P. C. E. of over 3000° F. The thin Adamant joints, highly resistant to flame, heat and the destructive action of gases, appreciably lengthen the life of the furnace wall and thereby reduce the time and cost for repairs or re-building.

Adamant, the original high temperature Fire Brick Cement and the complete line of Adaproducts, including Adahearth, for forming monolithic hearths . . . Adacast, for making special fire clay shapes . . . Adapatch, for patching walls, checking deterioration . . . are carried in stock by distributors in principal industrial centers. Write for the name of the Adaproduct distributor nearest you.

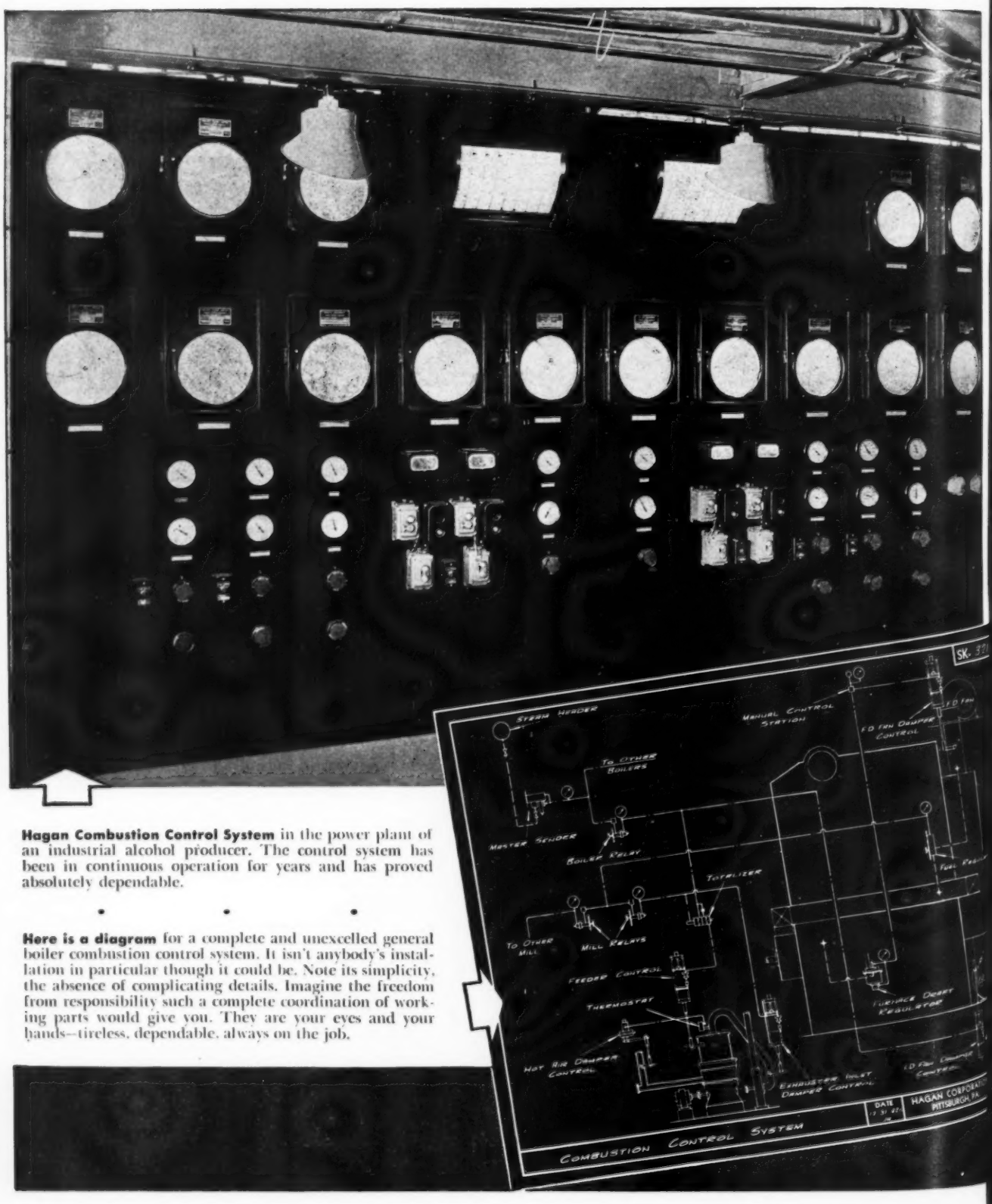
★ ★ ★

REFRACTORIES CO.

784 SOUTH SWANSON ST., PHILA. 47, PENNA.

In Canada: Canadian Botfield Refractories Co. Ltd., 171 Eastern Avenue, Toronto

Write your own



Hagan Combustion Control System in the power plant of an industrial alcohol producer. The control system has been in continuous operation for years and has proved absolutely dependable.

• • •

Here is a diagram for a complete and unexcelled general boiler combustion control system. It isn't anybody's installation in particular though it could be. Note its simplicity, the absence of complicating details. Imagine the freedom from responsibility such a complete coordination of working parts would give you. They are your eyes and your hands—tireless, dependable, always on the job.

Specifications

FOR COMBUSTION CONTROL

. . . and see how closely they are met by Hagan!

SUPPOSE you were to put down on paper your own conception of what an ideal system of Automatic Combustion Control should offer. It would look something like this.

1. It should be simple and foolproof. Hagan Control operates on a simple pneumatic system. The slightest or the most sudden change in steam pressure starts a chain of operations which quickly restores steam pressure to normal. This is all automatic and foolproof. No operator needs to watch instruments or make adjustments.

2. It should be absolutely dependable. Hagan Control is as carefully engineered as any machine. It does not depend on fragile instruments for its operation. Some of the first units of Hagan Control installed 25 years ago are still in daily service.

3. It should be accurate and flexible. Hagan Control is designed to operate accurately and quickly without "hunting." It is flexible in operation so that it can be used for any type of fuel with equally good results.

4. It should be economical with fuel. Fuel savings up to 10% are not unusual with Hagan Control. There are many cases where higher savings have been made. The general use of automatic combustion control in power plants has been a major factor in relieving fuel shortages in this war.

5. It should give uninterrupted service. Hagan Control is designed to stay in continuous operation in hot, dirty locations. It is built ruggedly and requires little maintenance or adjustment.

Find out about Hagan Control. It is used not only for boilers, but is also applied to all types of industrial furnaces, steel mills, and chemical processes.

HAGAN CONTROL ASSURES

MAXIMUM quantity of steam from any given plant, by introducing fuel and air in correct proportion for utmost efficiency.

MAXIMUM utilization value of steam, uniform steam pressure and temperature.

MAXIMUM output from boilers of differing capacities, automatically.

MAXIMUM steam for production, by reducing loss of steam in frequent soot blowing.

MAXIMUM protection of auxiliary equipment, fans, stokers, etc., by maintenance of uniform operating conditions.

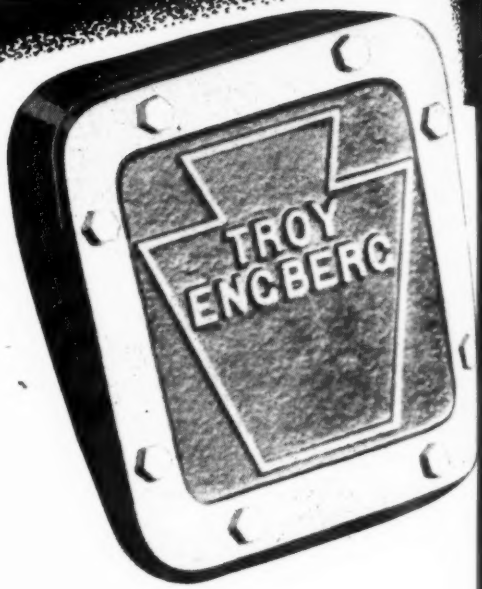
HAGAN CORPORATION · HAGAN BUILDING · PITTSBURGH 30, PA.

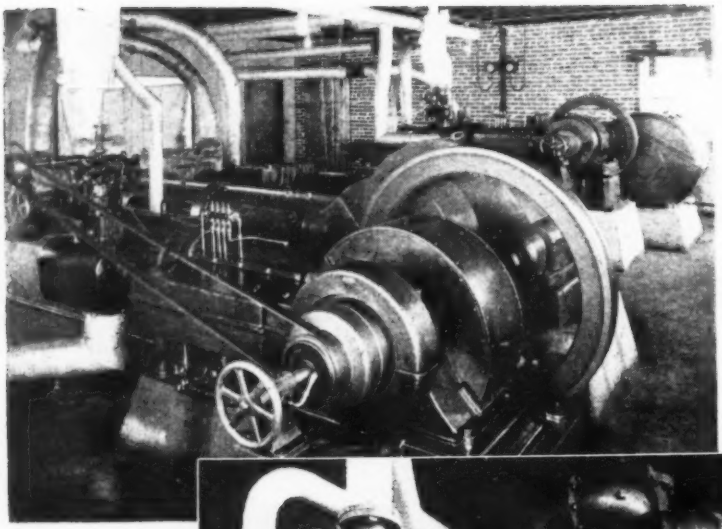
HAGAN
HALL
BUROMIN
CALGON

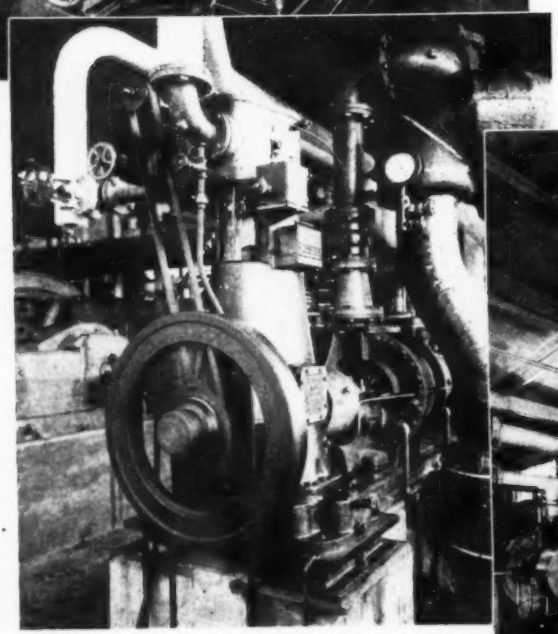
HAGAN *Automatic* COMBUSTION CONTROL

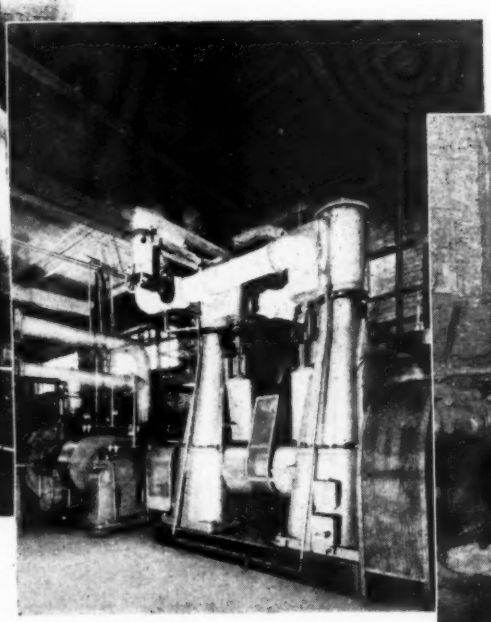
The pioneer . . . and still the leader

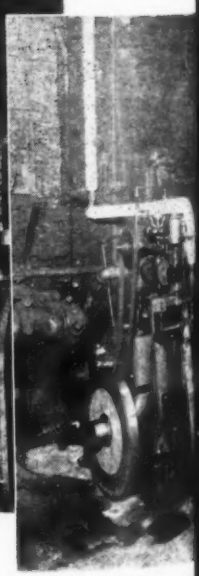
Savings BY THE STEAM ENGINE











★ BUY MORE WAR BONDS ★

STEAM ENGINES
GENERATING SETS

TROY

E QUICKLY PAY FOR THE DRIVE

HOW would you rate a drive that brings about such savings (over power costs required for other types of drives) that it would pay for itself and its installation costs in a year or two?

That's the record of the Troy-Engberg Steam Engine in many, many plants where it is driving stokers, compressors, fans, blowers, pumps, generators and other types of equipment.

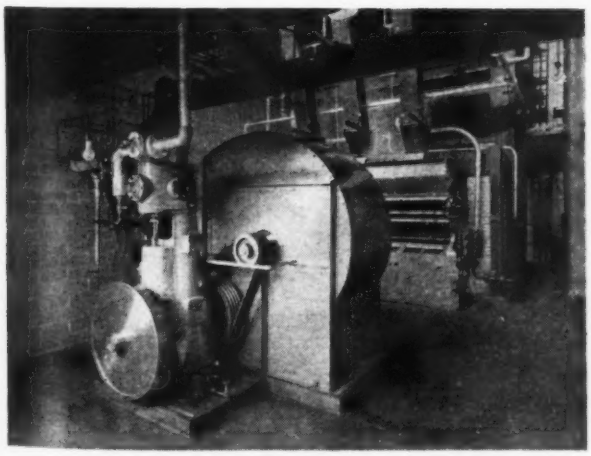
Along with its economy, the Troy Engine offers exceptional flexibility, high starting torque, ability to carry heavy overloads over long periods, and, of course, dependability.

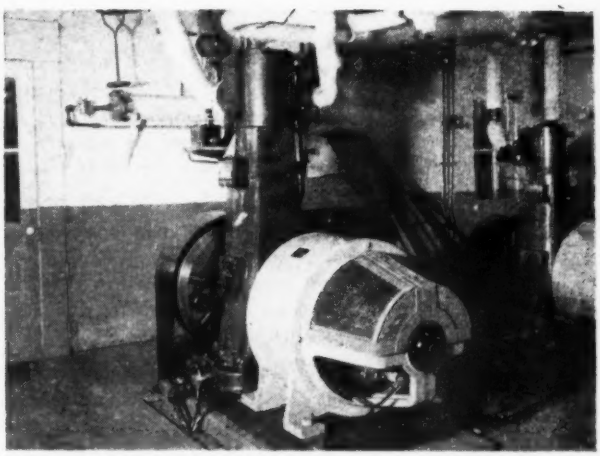
Plant engineers and operating men should always consider the Troy-Engberg Steam Engine when selecting a drive.

THE TROY ENGINE & MACHINE COMPANY

Established 1870

1495 Railroad Avenue **Troy, Pennsylvania**





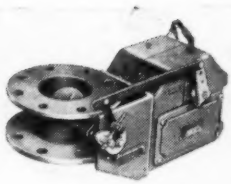
Y-ENGBERG

Save Time—Make Control and Shut-Off Sure and Easy

Slide Valve with lever control; also made with pull handle, hand wheel or chain wheel control

Butterfly Valve with self-locking worm gear and hand wheel control.

Wafer Butterfly Valve for pipe line "tightspots" hand lever or wheel control.



Butterfly Valve with electric motor operation for automatic, remote control.

Here are a few of the many types of Rockwell Valves made for air or gas flow control. They provide all the rugged construction features that assure easy control of flow and quick, positice shut-off under any temperature. They're made in any metal for any pipe size to 48", threaded or flanged, with any manual, mechanical or motorized control.

Rockwell Valves are made right for your job, priced right; quick delivery. Make your selection easy with new Catalog #406.

ROCKWELL VALVES

SLIDE and BUTTERFLY

FOR AIR • GAS • STEAM • LIQUIDS • SOLIDS

W. S. ROCKWELL COMPANY 48 Church St. New York 7, N. Y.

Be Ready With

VIKINGS on V-DAY

All-out production for War is still industry's most important job. But it's equally essential that industry plan ahead now to provide maximum profitable employment for our service men and women when they come home after Victory is won.

Adequate preparation should be the TARGET FOR TODAY in the battle of the home front. Preparation for the manufacture of Peace-time products, new and old. Development of new machines, improvement of former equipment. In short, preparation that has for its goal providing the greatest number of jobs possible when War contracts are terminated.

Ask Viking about "Rotary Pumps of the Future". Write today for Bulletin 800 which describes Viking Pumps widely used in the power equipment field. IT'S FREE.

VIKING PUMPS — FIRST IN AMERICA

VIKING Pump COMPANY

CEDAR FALLS, IOWA

Clamp – Splice – Tie – Repair – Mend – Reinforce *with*

PUNCH-LOK *Streamlined* BANDING METHOD

In all types of industry—production, maintenance or service—Punch-Lok Banding Method is at work . . . connecting hose, stopping leaks in steam or water lines, splicing electric cable, reinforcing and mending splits in cross-arms, poles and ladder rails, tieing rigid conduit or flexible cable to pipe lines or girders, seizing ends of wire or manila rope to prevent fraying . . . in short, wherever a banding method can be used to connect, mend, splice or reinforce. Open end bands available for use when ends of work are obstructed. There are places in *your* industry where Punch-Lok Clamps would save you time and money.

CLAMPS . . . Made of flat, high tensile galvanized steel or of Everdur, which is a corrosion resistant copper base alloy. All clamps are double wrapped. Available from ¾" to 48" I.D. Any larger size clamp can be pulled down to fit any smaller diameter.

LOKING TOOL . . . Sturdily constructed to assure long life. Locks all size clamps with a sufficient tensional pull.

GROOVED FITTINGS . . . For hose lines—air, water, steam or any other fluids. Permits application of high pressure clamping without damage to hose.

★ Write for Descriptive Catalog and Name of Local Distributor

PUNCH-LOK COMPANY

Dept. P. 321 N. Justine St.
Chicago 7, Illinois

★ pipe insulation

. . another job for

FIBERGLAS*

In cooperation with the Government program to save critical fuel.

. . . and if it's pipes that need covering — or re-covering — Fiberglas PF Pipe Insulation is the answer. It provides a highly efficient and convenient method of insulating steam and other hot lines of all sizes up to 30″ O.D. for temperatures up to 600° F.

Fiberglas PF Pipe Insulation is exceptionally lightweight, consisting of fine glass fibers bonded with a thermosetting binder and molded into hemi-cylinders and segments.

The unusually low thermal conductivity of Fiberglas PF Pipe Insulation produces significant direct savings of heat and power. And the unique characteristics of this material bring installation and maintenance economies that have also helped to win industry-wide approval and acceptance.

Because of its mechanical strength, this pipe covering holds its shape, withstands handling and is easily applied, even on the largest pipes—where only three segments are required. The material is easily cut with a knife and the fibrous ends of sections interlace to form tight joints.

Fiberglas does not rot or decay, disintegrate or pack down under vibration.

For more information on Fiberglas Pipe Insulation or the many other uses of Fiberglas, write for booklet, "Fiberglas Insulations for Industry", *Owens-Corning Fiberglas Corp., 2000 Nicholas Bldg., Toledo 1, Ohio. In Canada, Fiberglas Canada, Ltd., Oshawa, Ontario.*

OTHER FIBERGLAS INSULATIONS

1. No. 60 PF Block—Same materials as in PF Pipe Covering—in blocks 6″ x 36″ and 12″ x 36″, standard thicknesses.

2. OC-1800 High Temperature Block—A highly efficient and rugged molded block in sizes 6″ x 36″ and 12″ x 36″—in standard thicknesses. Will withstand surface temperatures up to 1800° F.

3. Metal Mesh Blankets—With mesh wire or expanded metal on one or both sides. Light weight, and easily applied. 2 ft. x 4 ft. and 2 ft. x 8 ft. In standard thicknesses. Two types: For temperatures up to 600° F. and 1000° F.

4. Blanket Type Pipe Insulation—With mesh wire on outer side to wrap around pipe and secure with wire through special edging. Manufactured in 2-ft. sections for pipes over 3″ O.D. Will withstand temperatures up to 1000° F.

5. Insulating Cement—For insulating fittings, valves and all irregular surfaces. Highly efficient . . . withstands temperatures up to 1200° Fahrenheit.

6. OC Mastic—An asphalt emulsion cement for insulated pipe and equipment exposed to outdoor or high moisture conditions.

7. TW-F Wool—Fabricated in bats, rolls and bulk. Used for drying-ovens, heaters, etc., for filling irregular spaces and for fireproofing.

8. PF Board—Manufactured in 5 densities from 2½ to 9 lbs. per cu. ft.—standard sizes 24″ x 48″, 1″ to 4″ in thickness. For insulated panels, sound absorption and various structural applications.

9. PF Roof Deck Insulation—9 lb. density with facing to facilitate mopping. Highly efficient, fireproof, rotproof and moisture-resistant board, for application under industrial built-up roofings. Sizes 24″ x 48″. Thicknesses from 3/16″ to 2″.

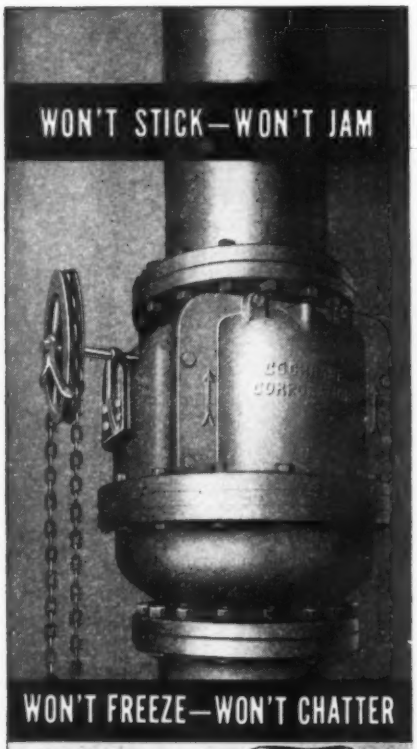
To help you make the proper selection, a "Fuel Savings Calculator" is available for determining heat loss, fuel savings and other factors. Write us for one.

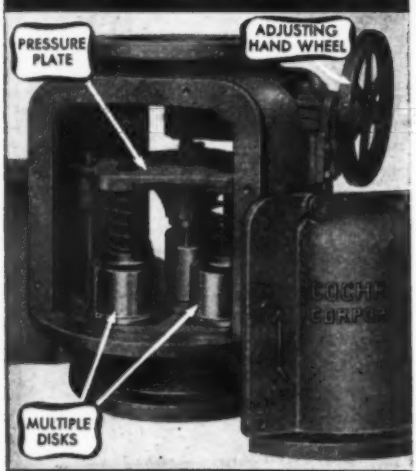
ARMY E ★★ NAVY

FIBERGLAS

*Trade Mark Reg. U. S. Pat. Off.

INDUSTRIAL INSULATIONS





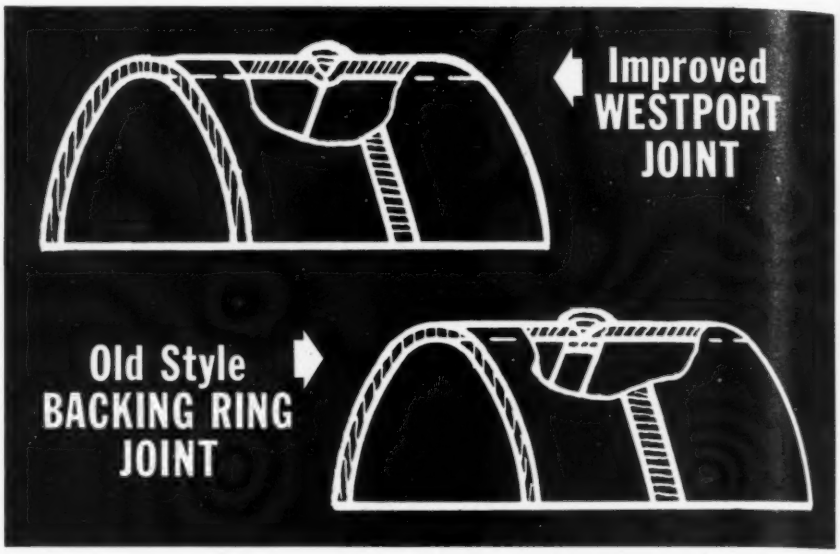
EASILY ADJUSTABLE

SAFETY silence and tightness are the outstanding characteristics of the Cochrane Multiport Relief Valve. A number of small disks, each with an independent holding-down spring, are used in place of a single disk. Thousands are giving satisfaction.

COCHRANE CORPORATION
3106 N. 17th Street, Phila. 32, Pa.

COCHRANE
MULTIPORT RELIEF VALVE

Don't Weaken Your Pipes By Welding Them Wrong



THE WESTPORT JOINT
Produces *SOUND* Welds

Here's why The Westport Patented Joint welding permits fusion buttwelded joints to be made from one side only, with complete penetration to the root of the weld. This new method . . . especially suitable in the welding of heavy wall piping for high pressure temperatures . . . is proving satisfactory in lines operating at 1250 pounds per square inch and 925 degrees F. total temperature steam service, on installations made as early as 1939.

The Westport Welded Joint provides:

(1) Greater Flexibility in Alignment of pipes, valves and fittings.
(2) Complete penetration to root of weld.
(3) No constriction in pipe area due to Backing Rings.
(4) No sacrifice in strength of the pipe due to removal of wall or Backing Ring.
(5) Smooth pipe contour at base of weld with no "icicles" or protrusions.
(6) Meets A.S.M.E. Code Requirements.

1899 1944

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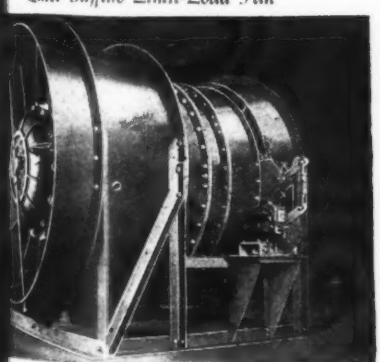
W. K. MITCHELL & CO., Inc.
PHILADELPHIA 46, PENNA.

Altitude wind tunnel, NACA aircraft engine research laboratory, Cleveland, Obio

NACA Altitude Wind Tunnel uses 107 "Buffalo" Fans

Quiet Buffalo Limit-Load Fan



Special Buffalo Axial Flow Fan

● The new Altitude Wind Tunnel at the Aircraft Engine Research Laboratory of the National Advisory Committee for Aeronautics at Cleveland is the only one of its kind in the world. Designed to provide engine research facilities under exact atmospheric operating conditions, subzero temperatures found at 30,000 feet elevation are easily maintained. The tunnel is strong enough to withstand external atmospheric pressure when the pressure inside corresponds to 50,000 ft. altitude, or 1.7 lbs. absolute. And both low temperature and pressures are maintained with air speeds in the tunnel up to 500 miles per hour!

The engineering problems involved in the design of a successful tunnel of this kind are enormous. For example, while the 31-foot, 12-blade tunnel propeller fan is driven by an 18,000 horse-power electric motor, the *total* power used for all equipment when testing a 3,000 hp aircraft engine at 30,000 feet altitude and 500 mph. air speed is in excess of 50,000 horsepower. The main tunnel fan creates air speed in the tunnel; auxiliary air-moving equipment supplies refrigerated air, exhausts engine fumes, removes air to simulate stratosphere condition, and provides ventilation.

One hundred and seven "Buffalo" fans of various types and sizes are installed on this job . . . a further tribute to the reliability and efficiency of Buffalo air-moving equipment, and to the fact that "Buffalo" has the RIGHT fan for every air- or gas-handling requirement.

Buffalo Sales Representatives located in all principal cities, will be glad to work with you on the selection of fans or air conditioning equipment. Call on them.

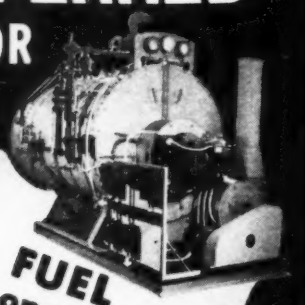
"Buffalo" "First For Fans"

BUFFALO FORGE COMPANY

BUFFALO New York ● BUFFALO PUMPS, INC. • THE GEO. L. SQUIER MFG. CO. CANADIAN BLOWER & FORGE CO. LTD. • CANADA PUMPS, LTD.

Buy WAR BONDS

Typical FUEL SAVINGS with PREFERRED UNIT STEAM GENERATOR



FUEL For one year at 60% EFFICIENCY $7200

FUEL For one year at 80% EFFICIENCY $5400

saved: $1800

A "pre-war" steam boiler—the type universally in service today and designed probably 15 years ago—burning $7200 worth of fuel per year can be replaced with a Preferred Unit Steam Generator at a yearly saving of $1800.

60% was the efficiency rating of pre-war boilers when new. The now new Preferred Unit Steam Generator has an efficiency of 80% or better.

Boiler, oil burner, induced draft fan, controls, piping, wiring, all assembled and perfectly coordinated into one complete portable unit. Ready to start producing steam after a few simple connections. No special foundation needed—no stack.

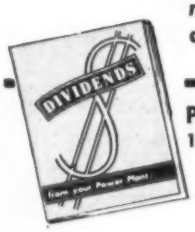
Compact. Requires but half the space occupied by pre-war plants of similar capacity. Comes in 20 to 500 H.P. sizes.

Operates automatically, with minimum attention.

In fuel savings alone, a Preferred Unit will pay for itself in just a few years.

SEND FOR FULL INFORMATION

Free descriptive Bulletin No. 1000A giving full details, also valuable service booklet—no advertising—DIVIDENDS FROM YOUR POWER PLANT—that is helping engineers interest their company heads in installing modern boiler room equipment—BOTH FREE. Send coupon today.



PREFERRED UTILITIES MANUFACTURING CORPORATION
1860 Broadway, New York 23, N. Y.

Please send, without obligation the bulletins checked.

☐ UNIT STEAM GENERATOR
☐ DIVIDENDS FROM YOUR POWER PLANT

NAME _____

ADDRESS _____

P-10-44

PREFERRED UTILITIES

Troubled with FIRE-SCALE and SOOT?

Use XZIT

FIRE-SCALE AND SOOT ERADICATOR

Today, few power plants can afford to waste time and labor to remove fire-scale and soot by old manual methods. Xzit reduces these fuel-wasting deposits chemically, so they may be dissipated automatically by natural draft or blowing.

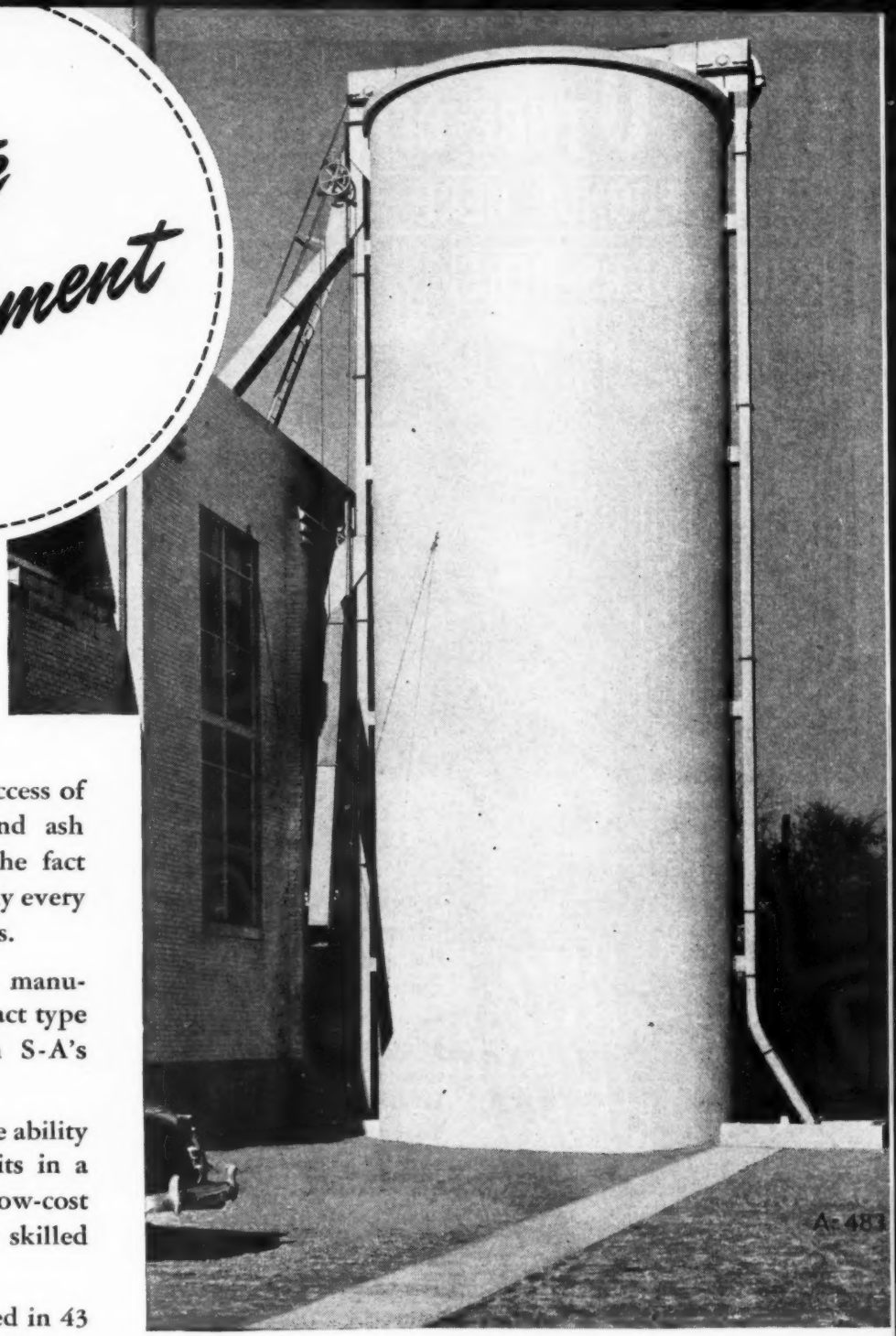
By simply feeding it into the fire-box while the boiler is in operation, Xzit keeps heating surfaces clean, reduces blowing, maintains uniformly higher boiler temperatures and lower stack temperatures, and reduces maintenance.

Write for Xzit sample or demonstration in your plant.

XZIT SALES CO.
1031 Clinton St., Hoboken, N. J.

Complete Encirclement

OF COAL HANDLING PROBLEMS THROUGH S-A ENGINEERING AND EQUIPMENT



A vertical closed-circuit REDLER elevator completely encircles the above 300 ton storage silo. Coal is discharged into the top and reclaimed from underneath the silo. The chute from the REDLER elevator delivers coal directly to the boiler room. A long underground REDLER conveyor conveys coal from a distant track hopper to the right hand base of the silo where coal is transferred to the elevator.

The key to the success of Stephens-Adamson coal and ash handling systems lies in the fact that this company can supply every element necessary to success.

Adequate equipment, all manufactured by S-A, of the exact type needed is available from S-A's broad line.

Competent engineering, the ability to assemble machinery units in a way to assure rapid and low-cost handling, is provided by skilled S-A engineers.

Valuable experience, gained in 43 years of specializing in material handling, serves to guide and direct S-A engineers at every planning stage.

Make these your reasons to consult S-A on your next handling job. Write us now.

STEPHENS-ADAMSON MFG. CO.

5 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

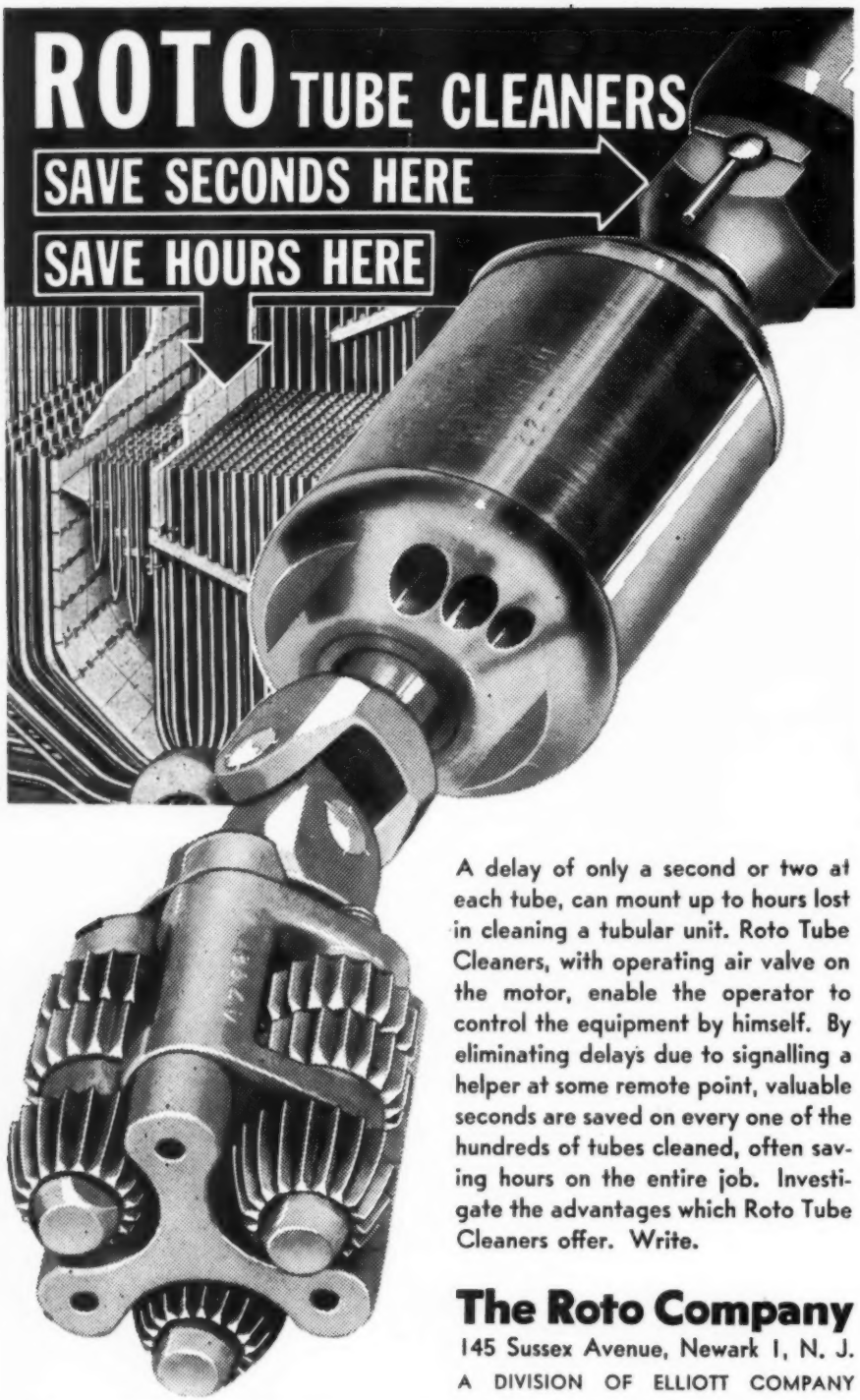
Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

ROTO TUBE CLEANERS

SAVE SECONDS HERE

SAVE HOURS HERE



A delay of only a second or two at each tube, can mount up to hours lost in cleaning a tubular unit. Roto Tube Cleaners, with operating air valve on the motor, enable the operator to control the equipment by himself. By eliminating delays due to signalling a helper at some remote point, valuable seconds are saved on every one of the hundreds of tubes cleaned, often saving hours on the entire job. Investigate the advantages which Roto Tube Cleaners offer. Write.

The Roto Company

145 Sussex Avenue, Newark 1, N. J.

A DIVISION OF ELLIOTT COMPANY

ALLPAX

THE PACKING THAT "PACKS ALL"

. . . use it once and

. . . you'll use it always

THE ALLPAX CO., INC.

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Distributors Everywhere

Here's the universal packing that can be used for any fluid or on any apparatus. One size packs all — economically, efficiently — tightly — simply.

Try ALLPAX and you, too, will be enthusiastic over its easy application and long wear. You don't have to remove old packing to repack with ALLPAX. Square cross section makes ALLPAX easy-filling in any stuffing box.

Try it and you'll always use it. Full details on request.

HOLD IT!

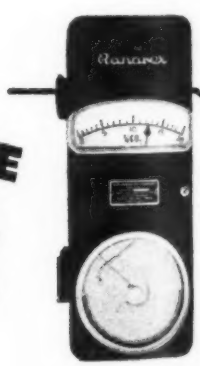
YOU'LL get along with *less* of that precious fuel if you'll stop wasting heat *up-the-stack.* Do this: Measure the CO_2 in your flue gases with the Ranarex* instrument. Adjust combustion till the percentage of CO_2 is exactly at the point known to be correct for your load. Then you're getting *all* the power possible from the fuel you burn.

Ranarex gives instant, accurate readings. It contains no chemicals or fragile parts to get out of order.

Write for free bulletin to The Permutit Co., Dept. A, 330 W. 42nd St., New York 18, N. Y. or Permutit Co. of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.

SAVE FUEL WITH



RANAREX

product of PERMUTIT

For Your Alco Heat Exchangers Get Your Replacement Parts from ALCO

HERE'S WHY! ALCO knows every part, every material, every dimension in every ALCO heat exchanger you use... ALCO knows why the materials are what they are... knows every permissible tolerance... knows your ALCO equipment through and through.

It is a distinct advantage to you to buy parts for your ALCO exchangers from ALCO.

ALCO can usually give you *quicker shipment* because ALCO stocks the *right materials*...right for the service and conditions in which your ALCO units operate ...has the equipment, the jigs, the "know-how."

In short:

1. Keep up your equipment by replacing worn or damaged parts *promptly*.
2. Know what you are getting: get your replacement parts from the original manufacturer.
3. For ALCO equipment *always* order replacement parts from ALCO.

Send for this Bulletin, No. 1026

Concise, handy, helpful. Tells how to install, operate, maintain ALCO Heat Exchangers... how to order spare parts. Copy sent promptly on request.

American Locomotive

ALCO PRODUCTS DIVISION

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30 Church Street, New York 8, N. Y.

Dunkirk, N. Y.

YOUR ANSWER for speeding wartime MAINTENANCE

Cleaning Surface Condensers

Cleaning surface condensers regularly pays for itself two ways. A higher vacuum is maintained. Operating efficiency is increased. But when you do this maintenance job, handle it the easier Oakite way.

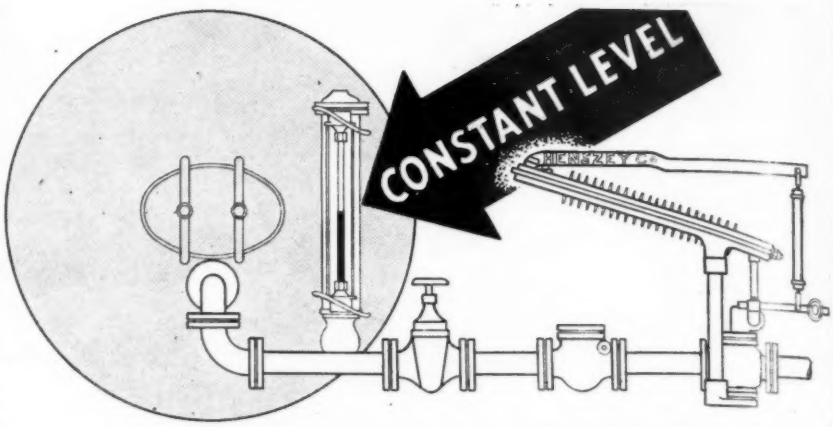
Plant-proved Oakite methods for (1) removing sludge and other insulating deposits from the steam side of tubes and (2) for removing lime scale and sludge from the water side are fast, effective. You will find Oakite degreasing and descaling solutions remove all deposits thoroughly, speedily. Normal vacuum is quickly restored. Shutdown time is reduced to a minimum.

New manual outlines methods for establishing significant savings on this and 64 other maintenance jobs. Write for your free copy.

OAKITE PRODUCTS, INC.
23 Thames St., New York 6, N. Y.
Technical Service Representatives Located in All Principal Cities of the United States and Canada

OAKITE *Specialized* CLEANING

Buy Bonds for Victory



SIMPLE *but* EFFECTIVE

Boiler Water Level Control

Your boilers, as well as all others, are designed to operate most efficiently when the boiler water is held to the proper level.

HENSZEY

BOILER FEED REGULATORS

will maintain proper boiler water levels continuously, automatically and accurately under all load conditions.

The Henszey Regulator is easily installed right in the feed line—no additional structural supports are needed. When feed water is needed this unit delivers it—in just the right amount to bring the level back to where it belongs.

Now is the time to plan for low cost, accurate boiler level control. Send for bulletin.

HENSZEY CO. *Dept. D-10 Watertown, Wis.*

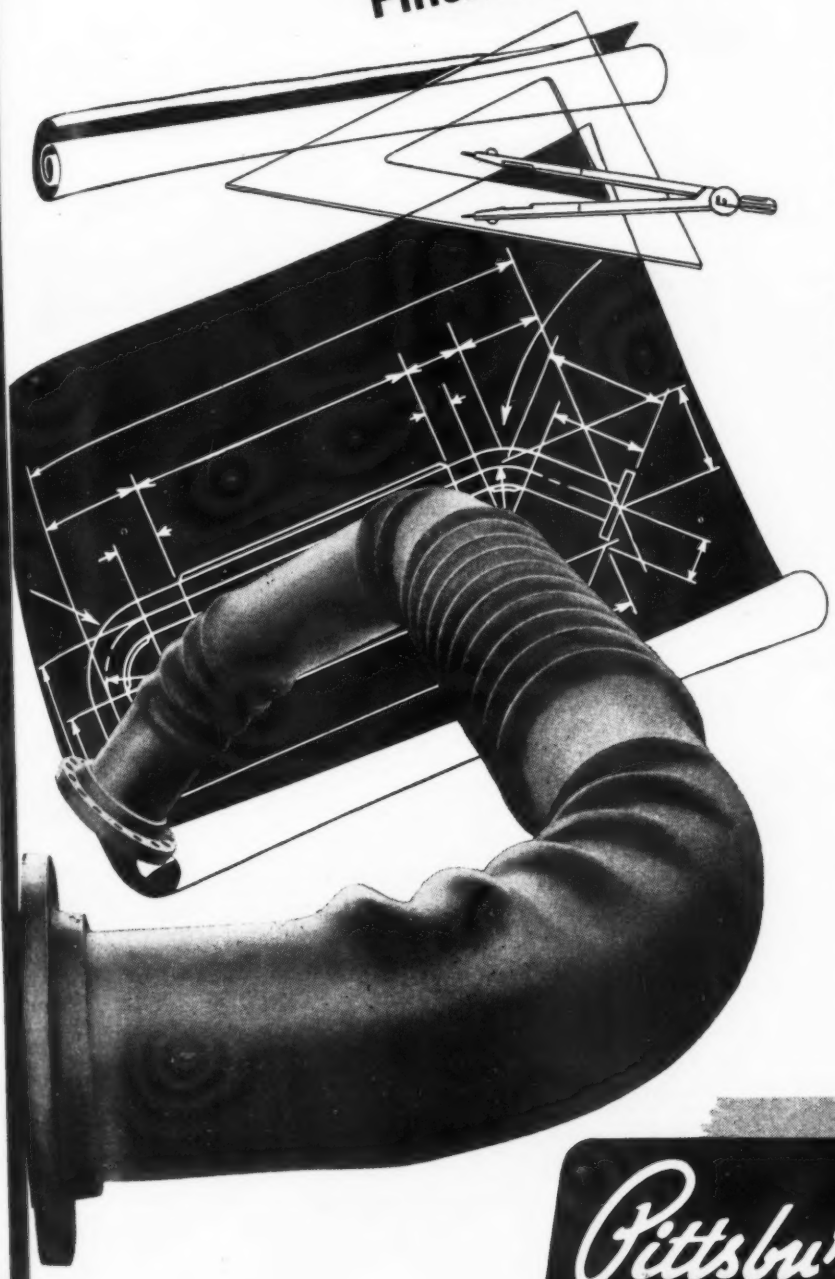
The Henszey Boiler Feed Regulator is made for pressures up to 600 lbs. and in sizes up to 4 inches.

HENSZEY

BOILER FEED REGULATORS

Continuous Blowdown • Distillation Systems • Heat Exchangers
Feed Water Meters • Flow Indicators • Proportioning Valves

Practical Planning for *Reconversion* calls for *Fabricated Piping* by Pittsburgh Piping and Equipment Co.



The best way to cushion the shock of reconversion from war-time to peace-time production is to plan new products and better products, and to make them ready for manufacture and distribution to a goods-hungry market in the shortest possible time after war production ends.

Efficient, economical production of improved products will undoubtedly call for alterations, additions or complete piping systems in central stations, chemical and process plants, paper mills and industrial plants. To help you in your reconversion program Pittsburgh Piping and Equipment Company's more than forty years experience in the fabrication and erection of piping is available to you.

Sound engineering, based on the practical as well as the theoretical aspects of the particular installations assures detail and layout of fabricated assemblies from the standpoint of both efficiency and economy . . . complete shop facilities for bending, welding, machining, heat treating, stress relieving, and assembling . . . field erection with proper testing and inspection under experienced supervision.

Combining all of these important functions into an orderly and properly integrated sequence of operation, assures you of the best in piping service.

Let our engineers help you in your planning. Contact our nearest representative or write us direct. There is no obligation.

ARMY E NAVY

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Pittsburgh Piping

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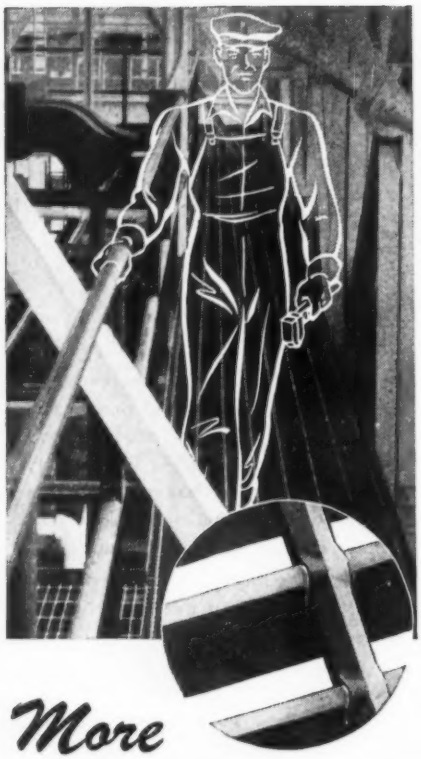

More

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MEAN STRONGER, SAFER STEEL FLOORING FOR YOU

• Now it's easier for you to get BATES•GRATES. That means you can have stronger, safer open steel flooring and stair treads in your plant, by utilizing the engineering advantages of BATES•GRATES.

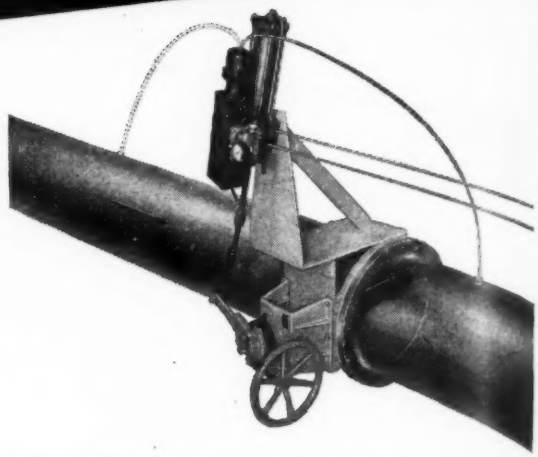
Extra strength, safety—*plus* easier maintenance—are due to the low-temperature, pressure-welding of hot rolled steel Hex cross bars to main bars. These qualities are obtainable only by using the Hex, fillet-welded design . . . and they cost nothing extra.

Send us your specifications.

The 16-page, illustrated BATES *booklet is a handy guide to plant improvement for all plant managers and engineers. Write for your copy.*

WALTER BATES COMPANY, INC.
JOLIET • ILLINOIS
OPEN STEEL FLOORING • STAIR TREADS

Maintain a Constant UPSTREAM or DOWNSTREAM PRESSURE



No. 501. 125-pound American Standard R-S Butterfly Valve. Declutching unit (patent applied for) permits operation of the valve with either the hand wheel or the positioner cylinder.

15 to 900 psi
for air, gas, steam, liquids and semi-solids

The R-S Butterfly Valve is controlled automatically by the line pressure and is actuated by the oil or hydraulic positioner cylinder attached to the valve. If the line pressure decreases, the valve vane slowly closes until the predetermined line pressure has been reached, at which time the valve vane automatically reopens.

The dotted lines indicate the piping necessary to maintain a constant upstream pressure.

The use of an R-S Butterfly Valve as a main control valve provides unexcelled flow characteristics, simplifies performance, prevents water hammer and reduces maintenance. Operates for pressures between absolute and 900 pounds gauge. State your requirements and ask for Catalog No. 14-B.

No. 529. 30-inch R-S Butterfly Valve with extension shaft for high pressure drops and heavy duty service. Only four to six revolutions of the handwheel are necessary for wedge-type closure.

VALVE DIVISION
R-S PRODUCTS CORPORATION
4536 Germantown Ave. • Philadelphia 44, Pa.

R-S Streamlined BUTTERFLY VALVES

No Other Type of Belting Can Equal LEATHER BELTING in the *Transmission of Power!*

...Here's Why: Leather has the highest coefficient of friction of any known belting material. This pulley-gripping capacity, which permits Leather Belting to drive heavy loads with minimum slip and negligible loss of power, actually increases as the load gets heavier.

Another factor in Leather Belting's supremacy as a power transmission medium is its *resiliency*. Its tough, fibrous structure "gives" under shock loads just enough to prevent damage to bearings and motors, yet returns to normal when the load is reduced. The great tensile strength of leather provides a high factor of safety, even under the most severe operating conditions.

Many comparative tests, as well as actual service records, have proved the superiority of Leather Belting over all types of substitutes in power transmission effectiveness. Add to this its long life, its ease of maintenance, its economy . . . and you can understand why more Leather Belting is used than any other type.

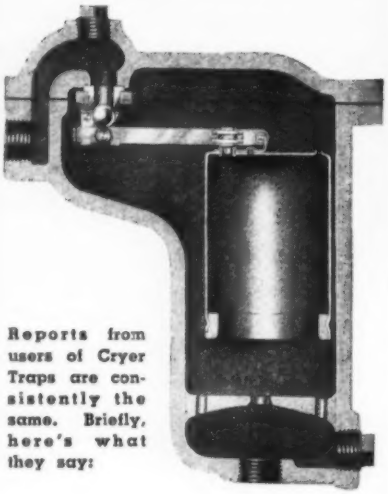
Here's How To Get Maximum Service from Your LEATHER BELTING

This handy and authoritative booklet contains a lot of useful information and suggestions that will help you to get the best service and longest life from your Leather Belting. A free copy may be obtained from your Leather Belting supplier or from us.

AMERICAN LEATHER BELTING ASSOCIATION
41 PARK ROW, NEW YORK 7, N. Y.

Let
*User Experience**
Be Your Guide - and Your
Choice, Too, Will Be

"CRYER"



Reports from users of Cryer Traps are consistently the same. Briefly, here's what they say:

*...."three years service and cleaned only two or three times"
...."no replacements (after three years) and 100% satisfactory"
...."performance entirely satisfactory" (after 5 years)
...."there has never been any sticking"
...."for their capacity, the bulk is less than other types."
...."price reasonable, spare parts always available."

"ALLS WELL WITH CRYER TRAPS."

It's not merely a question of being right when you install CRYERS, you simply can't go wrong, because experience proves this statement to be true. Investigation on your part will verify it. So, if you're really interested in using traps that give trouble-free service and which definitely do the job they are designed to do, you, too, will soon be a Cryer booster.

Sizes: ½" to 2½"
Capacities: 500 to 38,000 lbs. of water
Pressures: 0 to 250 lbs.

We carry all sizes of traps and spare parts for the line formerly known as the J-M Ball Steam Trap.

CRYER TRAP & VALVE CO.
366 Madison Ave., New York, N. Y.
Manufacturers of Steam Specialties for over 40 years
Mail Coupon Today

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I'd like to know more about Cryer Traps. Send details.
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Position .....
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AMERICA'S FASTEST SELLING BEARING METAL

WHY does MAGNOLIA ANTI-FRICTION METAL out-sell all other maintenance bearing alloys? There are three reasons:

MANY APPLICATIONS **Having the lowest coefficient of friction of any known bearing metal, it provides the best lining for nine out of ten applications.**

PRE-WAR COMPOSITION **While many bearing metals have disappeared from the market, MAGNOLIA ANTI-FRICTION is still available. And, furthermore, its composition remains unchanged.**

IMMEDIATE DELIVERY **Your local distributor carries this metal in stock. He can sell to you without a priority. No fuss . . . no delays.**

The next time bearings need relining, why not use this well known, widely accepted metal?

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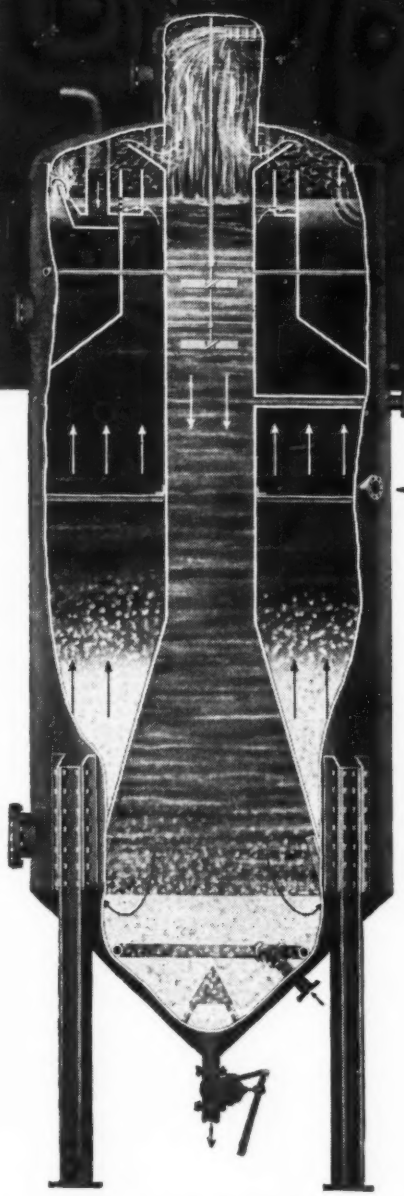
MAGNOLIA METAL CO. OF CANADA, LTD.
2028 Manufacturers Street
Point Ste. Charles, Montreal

MAGNOLIA BEARING METALS

Halfway measures don't pay

in feedwater treatment



This cross-sectional view of the Graver Hot Process Water Softening and Deaerating Unit shows flow and action of feed water. Like all Graver Water Conditioning Equipment it can be built in any size that service demands.

Maximum boiler efficiency and minimum operating costs can only be obtained through complete conditioning of boiler feed water.

Graver Hot Process Water Softeners with built-in Deaerating and Condensate Heating Equipment insure this efficiency and economy by providing *all three* necessary steps in a single unit.

A. ***Both the raw water and the condensate are heated with exhaust steam to within 2° of the temperature of the steam.***

B. ***Chemicals are added to the raw water causing precipitation of scale-forming constituents resulting in soft water of .5 gpg hardness.***

C. ***Both condensate and treated water are deaerated for the removal of oxygen and free CC_2.***

This three-in-one system of boiler feed water conditioning removes the danger of pitting, scaling, and corrosion . . . and gives you the added efficiency and economy provided by preheating.

This is but one example of Graver's ability to design and build water conditioning equipment to meet every individual requirement. Graver service is complete, from a careful analysis of your raw water supply through design, engineering, and manufacture to final installation.

Whatever your requirements, consult Graver. We'll gladly submit unbiased recommendations and estimates without obligation.

GRAVER

WATER CONDITIONING EQUIPMENT

Process Equipment Division
of

GRAVER TANK & MFG. CO., INC.

4809-25 Tod Ave., East Chicago, Ind.

NEW YORK CATASAUQUA, PA. CHICAGO TULSA

Hot Process Water Softeners—Zeolite Water Softeners—Water Filters—Iron Removal Filters—Oil Removal Filters—Reactivators—Chemical Mixing, Proportioning and Feeding Equipment

"FREDERICK" Stoker. Clinker type or side dumping grate. Sizes: 200, 300, 400, 600 and 850-lb. per hour feed.

Coal Saving is Power Saving

EVERY TON OF COAL SAVED means "more power from less fuel." Use of "FREDERICK" STOKERS has proved a sure means of saving coal; hence an important factor in providing more power at less cost.

Having been specializing in the design and construction of efficient stokers since World War I, we "wouldn't know how to make an inefficient stoker."

Considering the hundreds of "FREDERICK" INDUSTRIAL STOKERS in use in many industries, an astounding number of tons of coal are being saved.

Here are some of the reasons: Motors 25% larger than maximum requirement for normal load; Multi-vane type fan expressly designed for this service; relatively large coal feed screws which reduce power consumption; heavy-duty transmission operating in oil; large capacity hoppers; fully active grate surface; completely enclosed wind-boxes preventing air leakage.

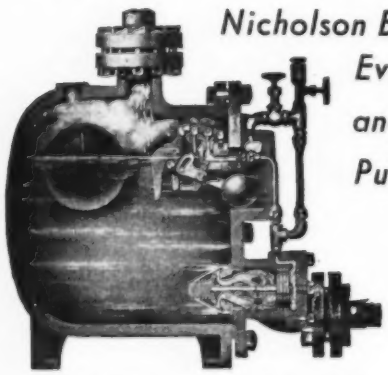
Study these and other features. Ask for the "FREDERICK" CATALOG.

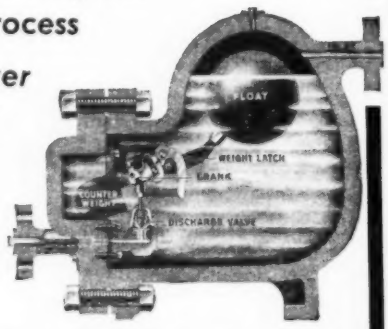
THE Frederick IRON & STEEL CO.
Frederick, Maryland

STOKER SPECIALISTS SINCE 1918

Specify "Nicholson" TRAPS FOR TOUGH TASKS

Nicholson Builds a Trap for Every Process and Power Purpose





PISTON-OPERATED STEAM TRAP

1. For pressures up to 650 lbs.
2. Positive, instantaneous discharge.
3. Non-wire-drawing valve.
4. Working parts of stainless steel.
5. Non-collapsible float.
6. Larger orifices.
7. Smaller size; larger capacity.

WEIGHT-OPERATED STEAM TRAP

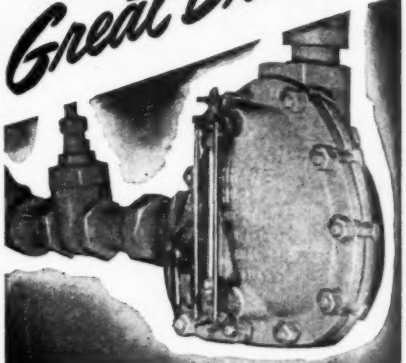
1. For pressures up to 1500 lbs.
2. Automatic, intermittent action.
3. Large capacity.
4. Resists action of dirt, vibration.
5. Non-wire-drawing valve.
6. Water-sealed discharge valve.
7. Working parts of stainless steel.

For Complete Features of Nicholson Traps Write for Catalog 444 or See Sweets.

W. H. NICHOLSON & CO. 125 OREGON ST. WILKES-BARRE, PA.

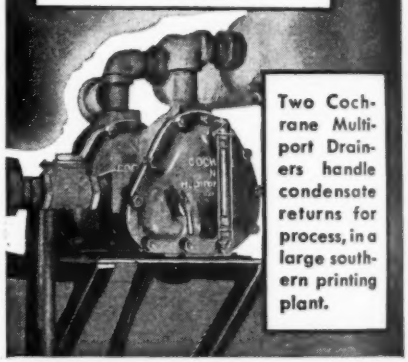
Valves—Traps—Steam Specialties

Tribute to a Great Drainer

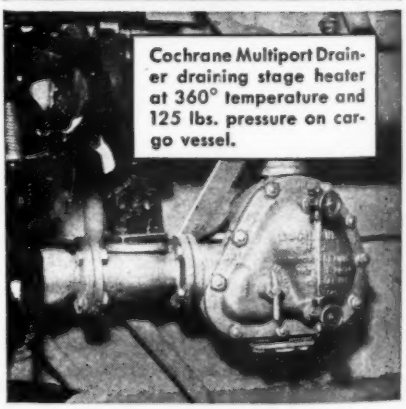


"These traps" (Cochrane Multiport Drainers) "discharge continuously, the valve opening being determined by the height of water in the float chamber; the larger the volume of water, the larger the valve opening. The rotating movement of the sleeve valve serves to keep the valve free of sludge accumulation."

—Steam Engineer of large New England paper mill.



Two Cochrane Multiport Drainers handle condensate returns for process, in a large southern printing plant.



Cochrane Multiport Drainer draining stage heater at 360° temperature and 125 lbs. pressure on cargo vessel.

Write for a copy of Publication 2925.

COCHRANE CORPORATION
3106 N. 17th Street, Philadelphia 32, Pa.

COCHRANE DRAINERS

NO REPLACEMENTS

OF *Springfield* CAST STEEL MUD

SINCE Springfield adopted cast steel for mud drums, over ten years ago, not one has been replaced. This is noteworthy as the mud drum of the boiler is less accessible than other parts for cleaning and inspection and is, therefore, the most likely spot for corrosion or pitting.

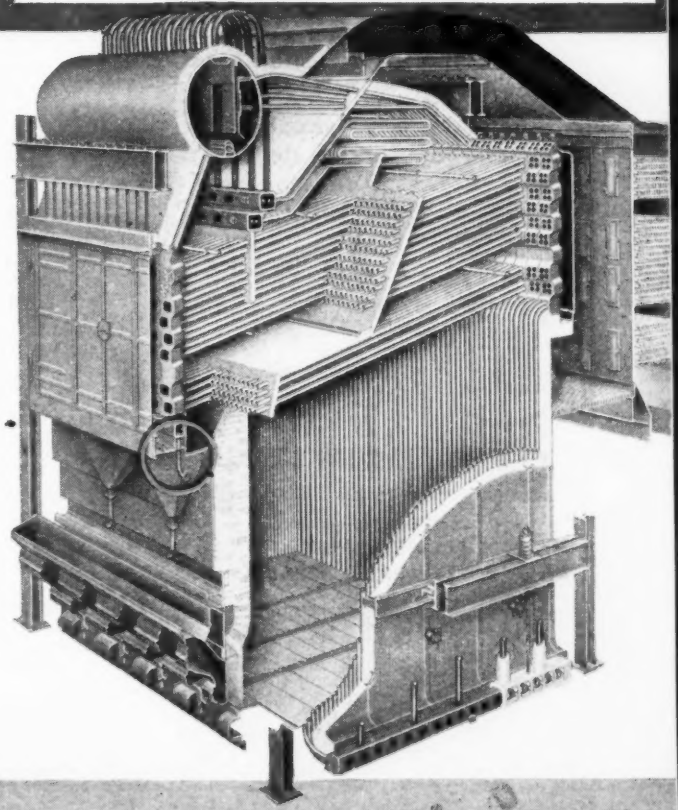
Originally the mud drums of Springfield Boilers were made of seamless steel pipe pressed to shape, as still used by other manufacturers. Replacements due to corrosion and pitting prompted us to seek some more suitable material for this vulnerable boiler part and so, in 1933, we started making our mud drums of the same material that had already proven so satisfactory in our sectional boiler headers—cast steel. Hundreds now in service with no indication of corrosion or pitting in any of them prove that our cast steel mud drums will give the same long service as our cast steel boiler headers.*

Resistance to corrosion is only one of the advantages of cast steel construction. Cast steel makes possible improved design. Ribbing and increased thickness are possible where greater wall strength is required. Tighter tube joints are possible because the softer metal of the tube (112 to 120 Brinell) is rolled into the harder cast steel (175 to 185 Brinell) under tremendous pressure. A wide variety of designs is made possible by casting, permitting flexibility to best meet requirements.

Through and through Springfield Boilers reflect advanced design that pays big dividends. Consider the plus values of a Springfield on your next boiler purchase.

CAST STEEL MEETS ALL REQUIREMENTS

Springfield header steel is produced by the Electric Furnace process with accurate control of chemical analysis. Foundry practice based on experience assures sound castings—fully annealed before leaving the foundry. Steel in the finished header is ductile as illustrated by the twisted and bent specimens and a 30" long turning produced in boring the header. Analysis and physical properties will comply with all construction Code requirements. Carbon steel, used for Springfield headers under 600 lbs. working pressure, tests 72,000 lbs. per sq. in. minimum tensile strength. For higher working pressures, strength is increased by use of alloy steel and ranges from 85,000 to 105,000 lbs. per sq. in. tensile strength.



SPRINGFIELD BOILER COMPANY

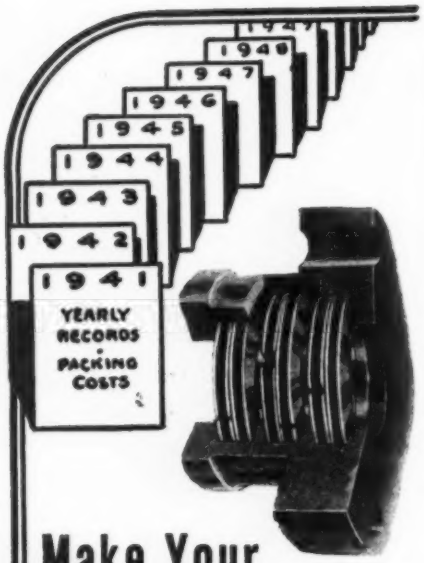
1953 East Capitol Avenue, Springfield, Illinois

*The probable life of these headers has not yet been determined as the earliest Springfield headers, now more than 30 years old are still in service.

SPRINGFIELD

STEAM GENERATING UNITS

ANY SIZE ANY FUEL ANY PRESSURE



Make Your Next Packing Job *L-A-S-T!*

During these days of increased production, it is especially annoying and costly to experience shutdowns due to packing trouble.

There is a solution. Install France "Full-floating" Metal Packing in your engines, pumps and compressors. The result is increased efficiency. And each job lasts for years without maintenance expense. Saves money, too, in the long run.

Installation is a simple procedure. See that the rings are installed as lettered to correspond with similar letters on the case. As simple as A-B-C.

Sold on approval — Satisfaction Guaranteed

Write for details and Folder M-7. Make your next packing job L-A-S-T!

THE FRANCE PACKING COMPANY

Tacony Philadelphia 35 Penna.

Mid-Continent Representative:

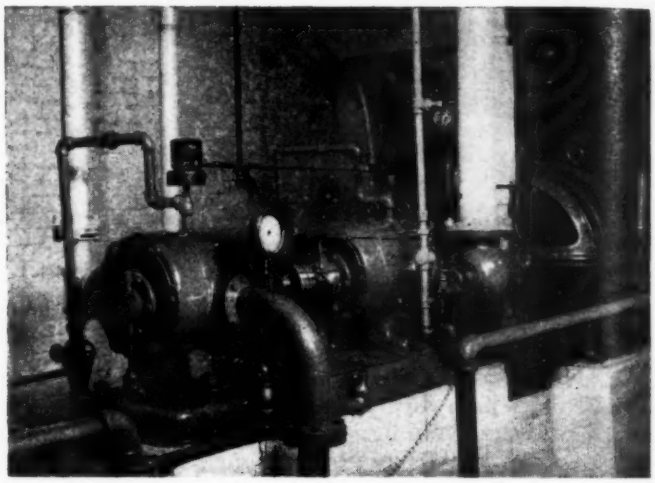
Mr. J. M. FULLER, 3725 West 7th St.
FORT WORTH, TEXAS

Original FRANCE METAL PACKING

YOUR COMPRESSORS — spot — WHERE YOU NEED THE AIR

Stop!

Wasting Power and Air



STOP that antiquated custom of compressing air at one central point, using large-size, high-pressure units working on pressures equal to the highest demand from any part of the plant.

STOP compressing air to a hundred pounds, or even higher, and then reducing it to lower pressures at the point of use.

STOP using long-distance pipe lines, with consequent leaks, and paying the added expense to prevent such leaks.

STOP paying out in power bills the excessive cost of forcing air through long transmission lines. Friction losses are direct losses.

STOP these costly practices . . . SPOT a Fuller Rotary Compressor where you need the air . . . at pressures required to do the work most efficiently and economically.

Write for Bulletin C-5

FULLER ROTARY COMPRESSORS

FULLER COMPANY

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SAN FRANCISCO 4 : 421 Chancery Bldg.
WASHINGTON 5, D. C. : 618 Colorado Bldg.

C-5

FULLER

PIONEERS OF HIGH-EFFICIENCY ROTARY COMPRESSORS

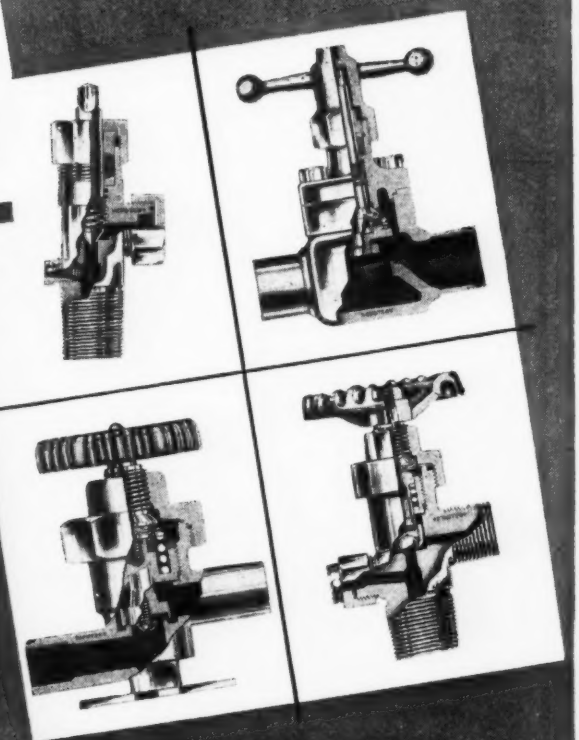
KEROTEST VALVES

Dependable Products always

the result of exacting
design and
proved engineering

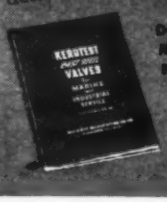
GATE, GLOBE, ANGLE SCREW DOWN CHECK TYPE VALVES

For industrial service, Kerotest builds top quality cast steel valves in standard sizes for all fluid operating pressures up to 1500 pounds. Kerotest Valves are built to A.S.A. specifications or to blue prints that meet your particular operating conditions.



PACKED AND PACKLESS SMALL VALVES

Compact Kerotest Valves have been designed to fit the specific needs of the chemical processing, air conditioning, refrigeration and kindred industries. They provide for easy installation in small spaces, insure against leakage, give longer service life with trouble-free positive control. Either through a Kerotest dealer or direct, obtain Kerotest quotations for your valve requirements.



Descriptive 32-page Marine Valve Catalog No. 43-M on request.

KEROTEST

KEROTEST MANUFACTURING COMPANY
PITTSBURGH, PENNA.

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THERMOMETERS

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TEMPERATURE CONTROLLERS

No. 90000 Self-Operating | No. V85002 Air-Operated Non-Indicating Type | No. M87000 Air-Operated Recording

PRESSURE GAUGES

No. 800 Steel Case | No. 600 Iron Case | No. 730 Hydraulic

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H.O.TRERICE CO.
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1420 W. LAFAYETTE BLVD.
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G-T

PACKINGS
THAT STAY SOFT
because they are self-lubricating

8 REASONS for the Superiority of G-T Packings

1. SIMPLE LINE . . . makes correct selection easy
2. COMPLETE LINE . . . an exactly suitable type for every service.
3. SELF LUBRICATING . . . each individual strand saturated with lubricant
4. SPECIAL LUBRICANTS . . . lubricant for each service specially compounded in our own plant
5. SELECTED YARNS . . . provide tensile strength and resist high temperature
6. CONSTRUCTION . . . assures maximum endurance, longest life, lowest friction
7. EXPERIENCE . . . 80 years of manufacturing experience
8. PERFORMANCE . . . proven in thousands of plants of every type

Pull apart a piece of any G-T packing, and you'll find the innermost strand as thoroughly saturated with lubricant as the outside of the packing. In contrast to ordinary packings, these inside strands are internal reservoirs of lubricant . . . they make G-T packings *self-lubricating.*

And the lubricant is not ordinary oil . . . it is specially compounded in our own plant for each class of service. That's why G-T packings stay soft . . . last longer . . . protect shafts, rods and stems. The table below tells you the right G-T packing for your requirements.

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PLANTS: New York, N. Y. and North Wales, Pa.

PALMETTO *for steam, hot water, air.* PALCO *for water.* PELRO *for oils.* CUTNO *for alkalis.* SUPERCUTNO *for acids.* KLERO *for foods, etc.* PALMETTO SUPERSHEAT **PACKINGS**

G-T *self-lubricating* PACKINGS

Homocord construction in CONVEYOR BELTS -another MANHATTAN development- war-proved for your post-war use

ADVANTAGES of HOMOCORD CONVEYOR BELTS

1. Complete bonding of every member into a homogeneous structure.
2. Holds metal fasteners.
3. Lateral flexibility permits perfect troughing, accurate training, reduces fatigue of flexing at bend in troughing idlers.
4. Resists destructive action of continuous or heavy impact feeding.
5. Cushion Homocord body and low inelastic stretch reduce wear and tear of top cover.
6. Homocord body reduces hazard of punctures.
7. Homocords so completely encased in Flexlastics, moisture not admitted, mildew cannot start. Manhattan Conveyor belts mildew-proofed throughout.
8. Longer life, lower cost per ton.

Here is a totally different type of Strength Member construction — developed in time to speed war production and now improved with FLEXLASTICS* for post-war use.

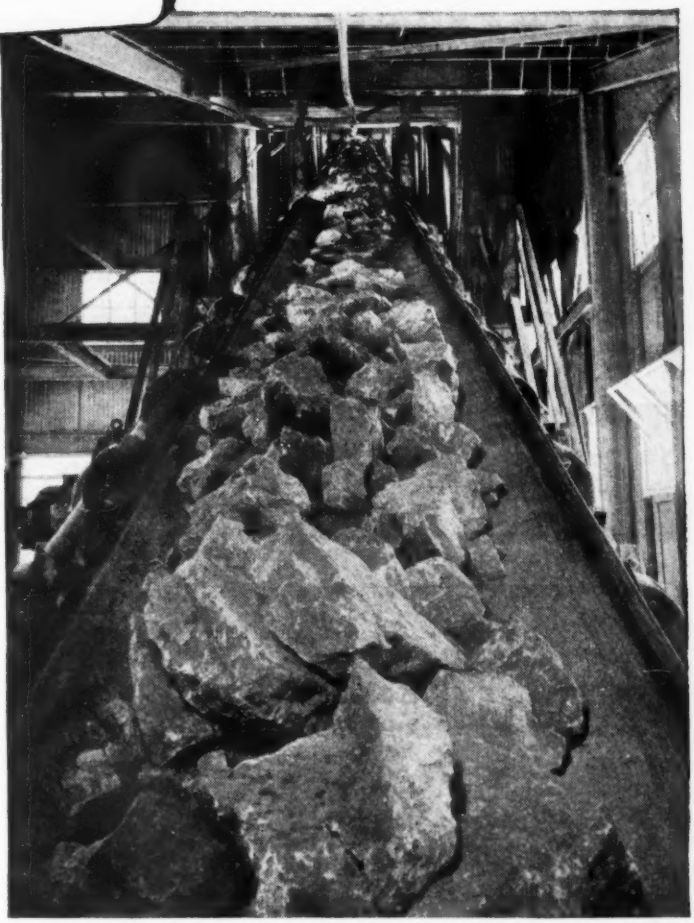
Pre-war installations have been delivering high tonnage on a steady basis that is adding to MANHATTAN'S already distinguished achievements in conveyor belt service.

Homocord construction has been invented and perfected by MANHATTAN engineers particularly and only for conveyor belt use, and is not designed for use in any other product. It is the first and only conveyor belt possessing virtues of a cord belt, but with the drawstrength and resistance to fatigue to hold metal fasteners. It marks a distinct milestone in conveyor belt progress.

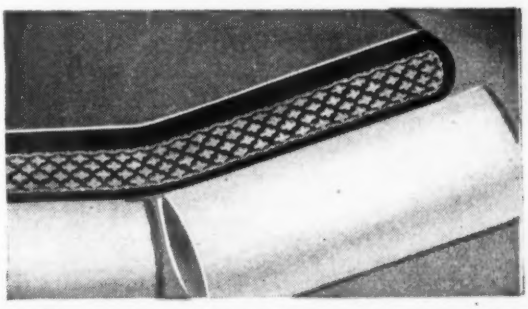
Longitudinal Homocords are grouped to give great tension strength and tied together with cross Homocords which allow exceptional troughing for full loading of the belt, plus the strength to permit use of fasteners.

These component Strength Members are sealed-in to make a homogeneous, pliable belt which flexes easily around end pulleys. The Homocords, embedded in moisture-proof FLEXLASTICS* and mildew-proofed as additional protection, have a flexible, resilient, rolling contact with each other to provide cushioned resistance for heaviest feed impact.

These are significant advantages that will help you meet tomorrow's needs. They are worth investigating now.



Homocord Conveyor handling unusually large pieces of limestone.



Detail of Homocord Strength Member construction. Note how open fabric structure permits rubber to penetrate and unite all parts into a homogeneous whole.

*The term FLEXLASTICS is an exclusive MANHATTAN trade mark. Only MANHATTAN can make FLEXLASTICS.

KEEP AHEAD WITH MANHATTAN

THE MANHATTAN RUBBER MANUFACTURING DIVISION
OF RAYBESTOS-MANHATTAN, INC.
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HERCULES
Seamless Copper
FLOATS

GUARANTEED
TO STAND UP!

Every Hercules Float carries our guarantee to stand up under 350 lbs. working pressure and 500 degrees temperature.

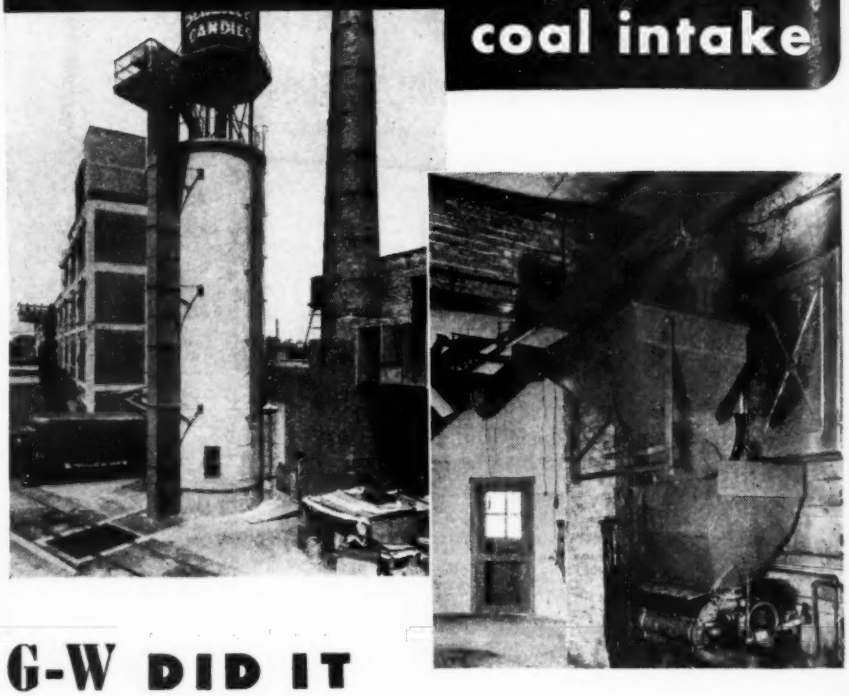
Fabricated of seamless copper under our special spinning process. Hercules Floats are uniform in thickness and high in mechanical strength.

You can depend on Hercules for floats—in standard shapes up to 10 in. and in special types to your specifications—to give long, dependable, economical service.

Insure care-free maintenance of water level in your heaters, tanks, reservoirs and other equipment by specifying "HERCULES."

HERCULES FLOAT WORKS
200 Franklin St.
SPRINGFIELD, MASS.

LICKED:– space shortage
SPEEDED:– coal intake



G-W DID IT
here's how

Track to Silo to Stoker is the Gifford-Wood way of solving the coal-handling problem for a well-known Chicago candy manufacturer. To overcome the handicap of severely limited storage space, G-W engineers examined the conditions . . . designed storage and handling equipment accordingly . . . built and supervised the erection of the entire system.

Briefly here are the facts and figures. A concrete pocket was designed and constructed between railroad siding and wall of boiler house. Silo diameter is 14′; its height 50′; its capacity 130 tons. Coal is discharged from cars into track hopper, conveyed by G-W double chain drag conveyor to elevator boot hopper, and elevated at rate of 30 tons per hour. Floor slab of pocket is 12′ above boiler room floor; curtain walls beneath it give direct access from boiler room to unloading gates. A 500-lb. hopper is filled through gates of four discharge chutes. Hopper is conveyed by trolley to scale for weighing, and thence to overfeed stoker hopper.

This small boiler plant installation, with its savings in time as well as space, is typical of the G-W method of designing handling systems to meet specific needs. Why not benefit by Gifford-Wood's experience, and ask for a plan and proposal based on your plant's needs? Write for Catalog 200-P.

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FOUNDED 1814

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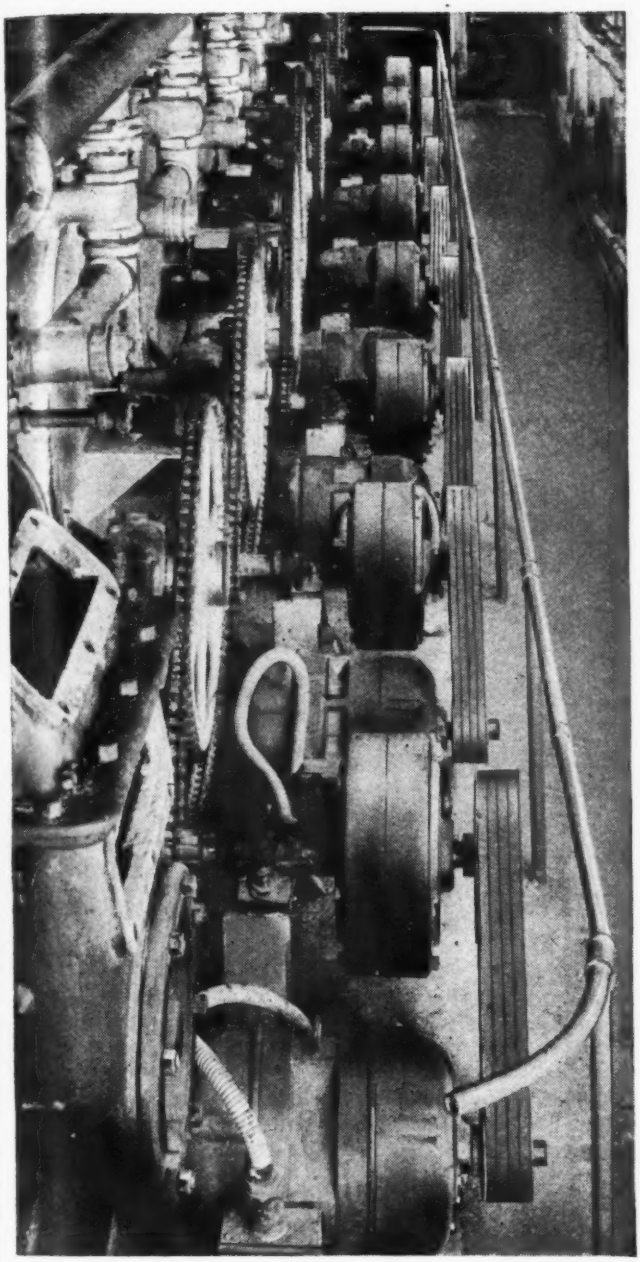
6461

Every IMO is tested

Each De Laval-IMO pump is tested under full load and every purchaser of a De Laval-Imo pump is, therefore, assured that his pump before shipment has demonstrated its ability to handle oil of given characteristics under the specified conditions. This is one of the ways in which our aim always to build the best is achieved in practice. • Ask for Catalog I-113.

IMO
I MOVE OIL

IMO PUMP DIVISION
of the De Laval Steam Turbine Company
Trenton 2, New Jersey



These eight fish cookers were originally driven by spur gears which were a constant source of trouble due to gear failure. This meant a shut-down of three to four weeks awaiting replacements. Last year the machines were equipped with American Reduction Drives as illustrated above and shut-down time due to drive failure was completely eliminated.

How to Simplify Your Slow-Speed Drives

In driving any machine, between 11 and 154 rpm.—with power requirements between ¼ and 25 hp.—the easiest solution is to install an American Reduction Drive.

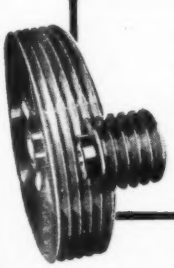
The standard 13 to 1 ratio Reduction Unit will deliver any speed between 11 and 154 rpm. by the simple selection of sheaves or pulleys of the proper size for the primary belt drive. And because the Reduction Unit is mounted on the shaft of the driven machine—just like a pulley—installation is quick and easy.

The American Reduction Drive is made in six sizes to handle jobs from ¼ to 25 hp. and can be used with any type of motor. Maintenance is reduced to a minimum because the primary belt drive acts as a cushion protecting both the gears and the motor against shock loads.

If you are installing or changing the drives on any slow-speed machines, be sure to get complete information on American Reduction Drives. Send for a copy of the 16 page catalog that gives you complete application, selection and installation information.

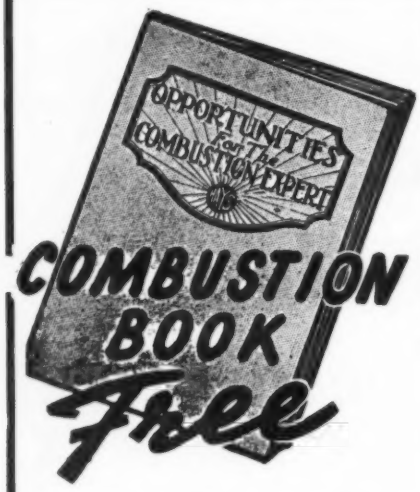
The American Pulley Company

4224 WISSAHICKON AVE., PHILADELPHIA 29, PA.



WEDGBELT SHEAVES

American Wedgbelt Sheaves are made to highest precision standards of sound, strong materials. Accurately machined, carefully balanced, they assure true-running performance.



Combustion efficiency as applied to Boiler Plant Operation, Fuels and Equipment is now a most important factor in Defense work. Fuels cost more than ever before. Boiler loads are heavier. A scarcity of some kinds of fuel is apparent.

The Combustion trained man—the Hays trained man—can do his part, and open up big opportunities for himself that never existed before, by devoting a little of his spare time in training himself to meet present conditions.

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Commonwealth Edison Company 145
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Cities Service (Oil & Power) 70
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How? Through the simple, easy reading, *practical* Hays Home Study Course in Fuel and Combustion Engineering. For 26 years the Hays Institute has specialized exclusively in training in Combustion Efficiency. Hundreds of Hays trained men now hold substantial positions of responsibility. What we have done for them we can do for you, in your spare time. Many companies urge their men to enroll. They know the value of Hays Combustion Training.

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FROM BUNKER TO STOKER . . .

RICHARDSON offers a COMPLETE SYSTEM for coal weighing and feeding

Burning too much coal can "burn up" a chief engineer who hates waste and is held responsible for it. The most *must* be gotten from every consignment of hard-to-get fuel. Many are finding that only a *complete system* can insure the strict fuel economy that today's conditions demand.

RICHARDSON furnishes a complete system of coal weighing and feeding—from bunker to stoker (or pulverizer). With it, you can obtain from a single, reliable manufacturer: (1) a dustproof and siftproof rack-and-pinion, ball-bearing gate to control coal from bunker; (2) any flexible upper spouting required; (3) Automatic Coal Scale of either of two styles, one for drawing from a single bunker opening, the other for drawing from multiple openings; (4) MONORATE non-segregating distributor to stoker, or conventional downspout to pulverizer.

Richardson's background of more than 50 years' experience includes these milestones in the company's history:—Its first automatic scales in 1889 . . . its first automatic scales for coal in 1910 . . . conveyor feed hopper type coal scales introduced in 1922 . . . electric model automatic coal scales made available in 1935 . . . streamline model automatic coal scale made available in 1939 . . . and Richardson product-development work continues unceasingly!

6413

RICHARDSON SCALE CO.
CLIFTON, N. J.
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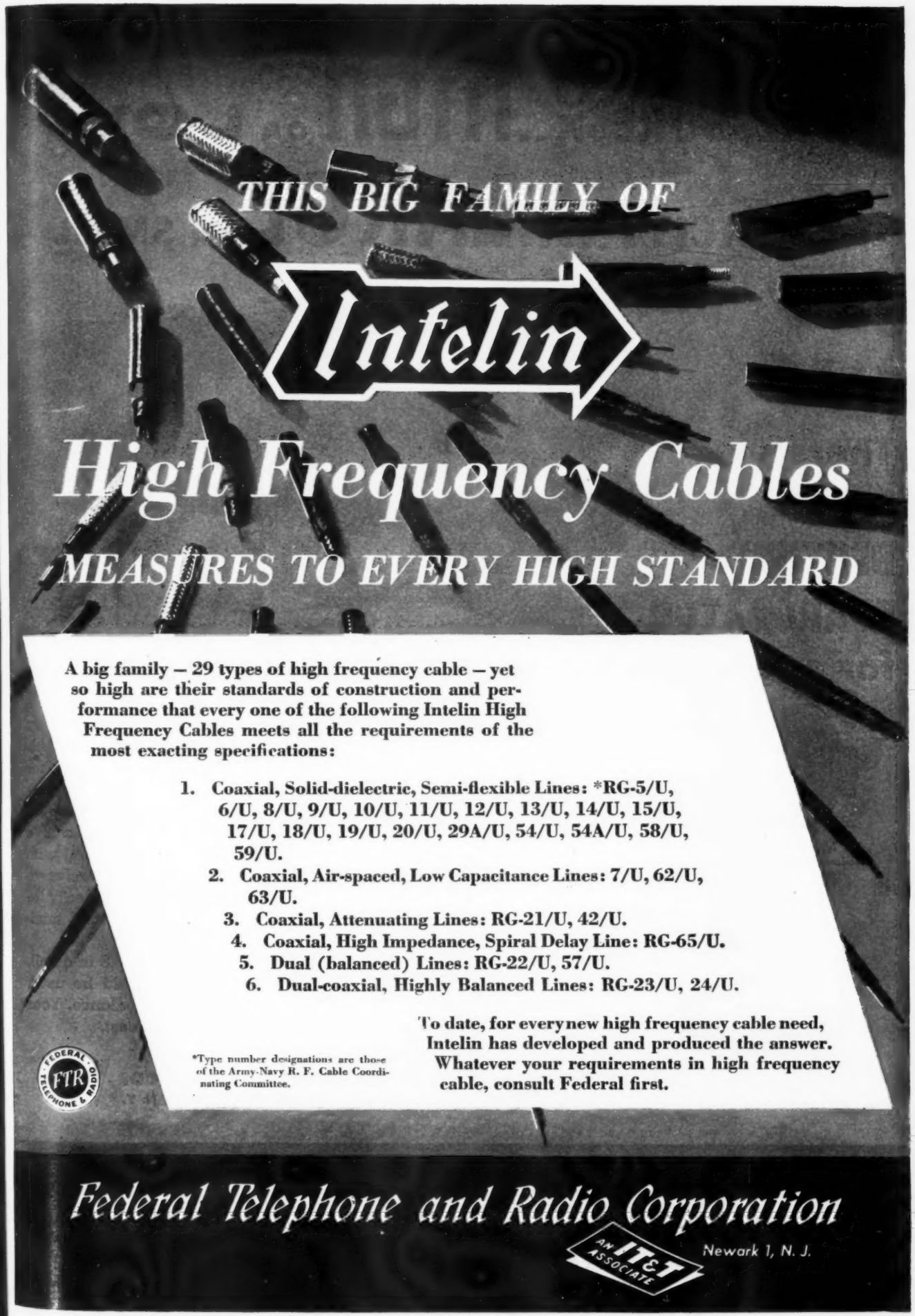


A big family — 29 types of high frequency cable — yet so high are their standards of construction and performance that every one of the following Intelin High Frequency Cables meets all the requirements of the most exacting specifications:

1. **Coaxial, Solid-dielectric, Semi-flexible Lines: *RG-5/U, 6/U, 8/U, 9/U, 10/U, 11/U, 12/U, 13/U, 14/U, 15/U, 17/U, 18/U, 19/U, 20/U, 29A/U, 54/U, 54A/U, 58/U, 59/U.**
2. **Coaxial, Air-spaced, Low Capacitance Lines: 7/U, 62/U, 63/U.**
3. **Coaxial, Attenuating Lines: RG-21/U, 42/U.**
4. **Coaxial, High Impedance, Spiral Delay Line: RG-65/U.**
5. **Dual (balanced) Lines: RG-22/U, 57/U.**
6. **Dual-coaxial, Highly Balanced Lines: RG-23/U, 24/U.**

*Type number designations are those of the Army-Navy R. F. Cable Coordinating Committee.

To date, for every new high frequency cable need, Intelin has developed and produced the answer. Whatever your requirements in high frequency cable, consult Federal first.

FEDERAL TELEPHONE & RADIO — FTR

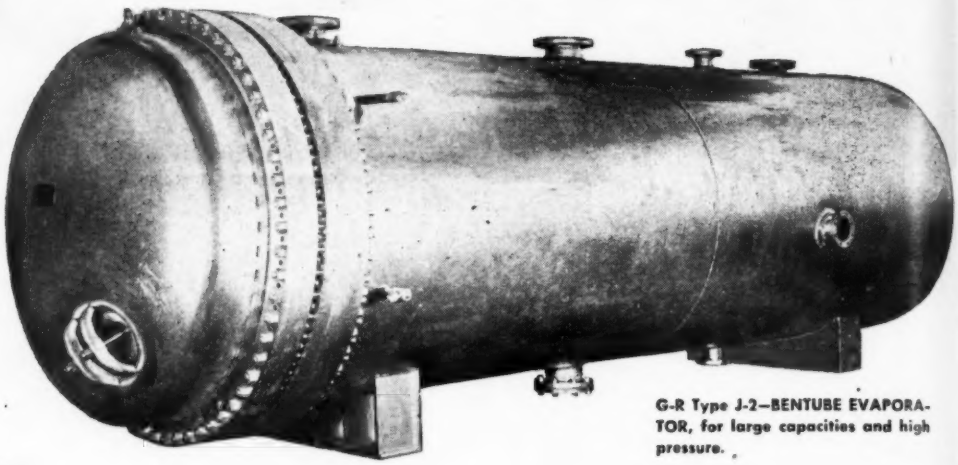
Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

Newark 1, N. J.

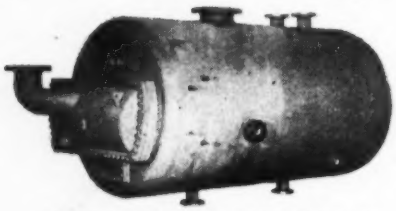
PRESSURE.....HIGH OR LOW

CAPACITY.....LARGE OR SMALL

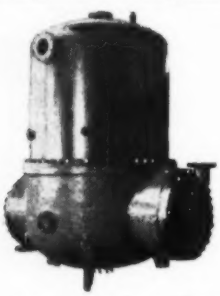


G-R Type J-2—BENTUBE EVAPORATOR, for large capacities and high pressure.

There's a G-R BENTUBE EVAPORATOR for every requirement of boiler feed make-up



G-R Type N—BENTUBE EVAPORATOR, for moderate capacities and low pressure.



G-R Type H — Vertical BENTUBE EVAPORATOR, for small capacities.

No matter what size or type of boiler-feed make-up evaporator may be best suited for your particular plant conditions, an exactly suitable G-R BENTUBE EVAPORATOR is available for your precise requirements.

The design of these evaporators . . . based on 75 years of experience in building heat transfer apparatus . . . has several distinctive advantages assuring vapor that is both pure and dry, and with large overload capacity. In addition, these units have exclusive features that *maintain* rated capacity without the necessity of hand-scaling, and provide greatest ease of inspection and minimum attendance.

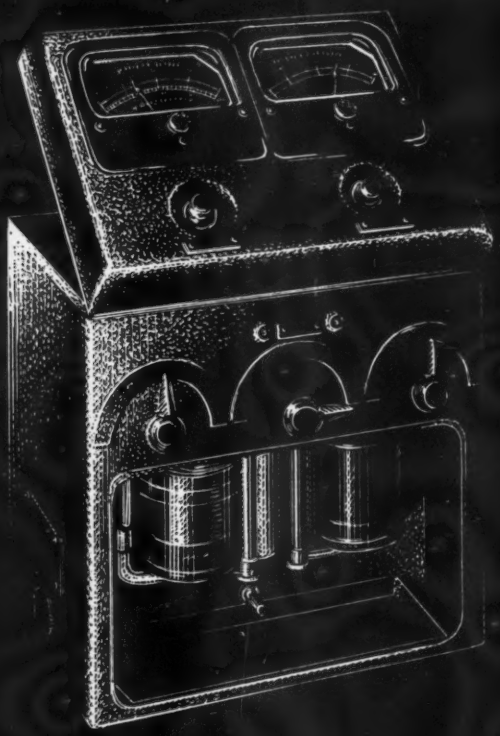
Bulletin 362 describes G-R BENTUBE EVAPORATORS in detail, explains in what plant conditions evaporators should be used, and analyzes their association with the plant heat balance. Your copy of this informative bulletin will be sent on request.

THE GRISCOM-RUSSELL CO.
285 MADISON AVENUE, NEW YORK 17, N. Y.

GRISCOM-RUSSELL

Pioneers in Heat Transfer Apparatus

EXAMPLE OF *Service*:



A chain of 150 motion picture houses was having consistent trouble with its power equipment. Many experts tried to correct it and failed... then one of our Cities Service Lubrication Engineers tackled the problem. With the exclusive Cities Service *Industrial Heat Prover* he analyzed combustion... made necessary adjustments. In the two years since, these plants have shown greater efficiency, lower operating costs.

More and more, it's service that counts...

and *Cities Service* means good service!

CITIES SERVICE OILS — ONCE-ALWAYS

CITIES SERVICE OIL COMPANY

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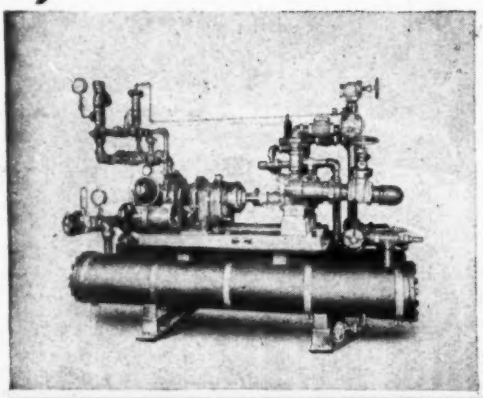

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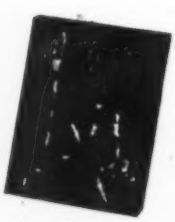

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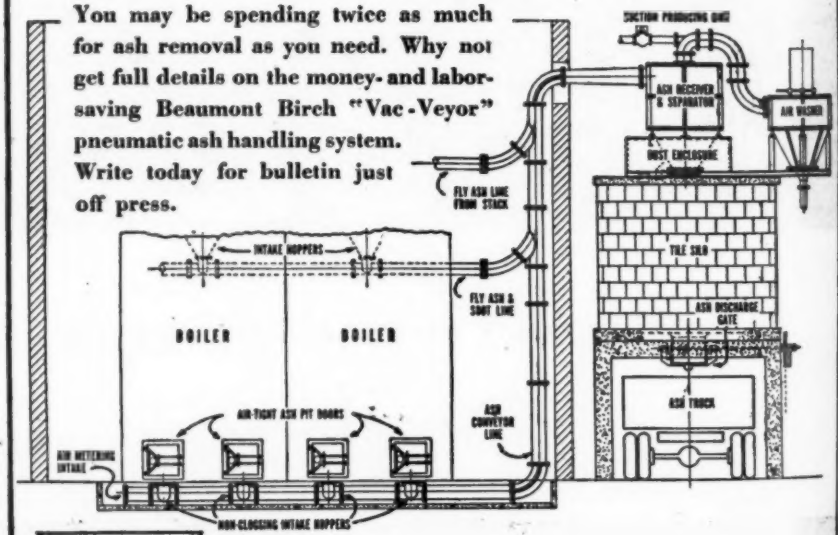

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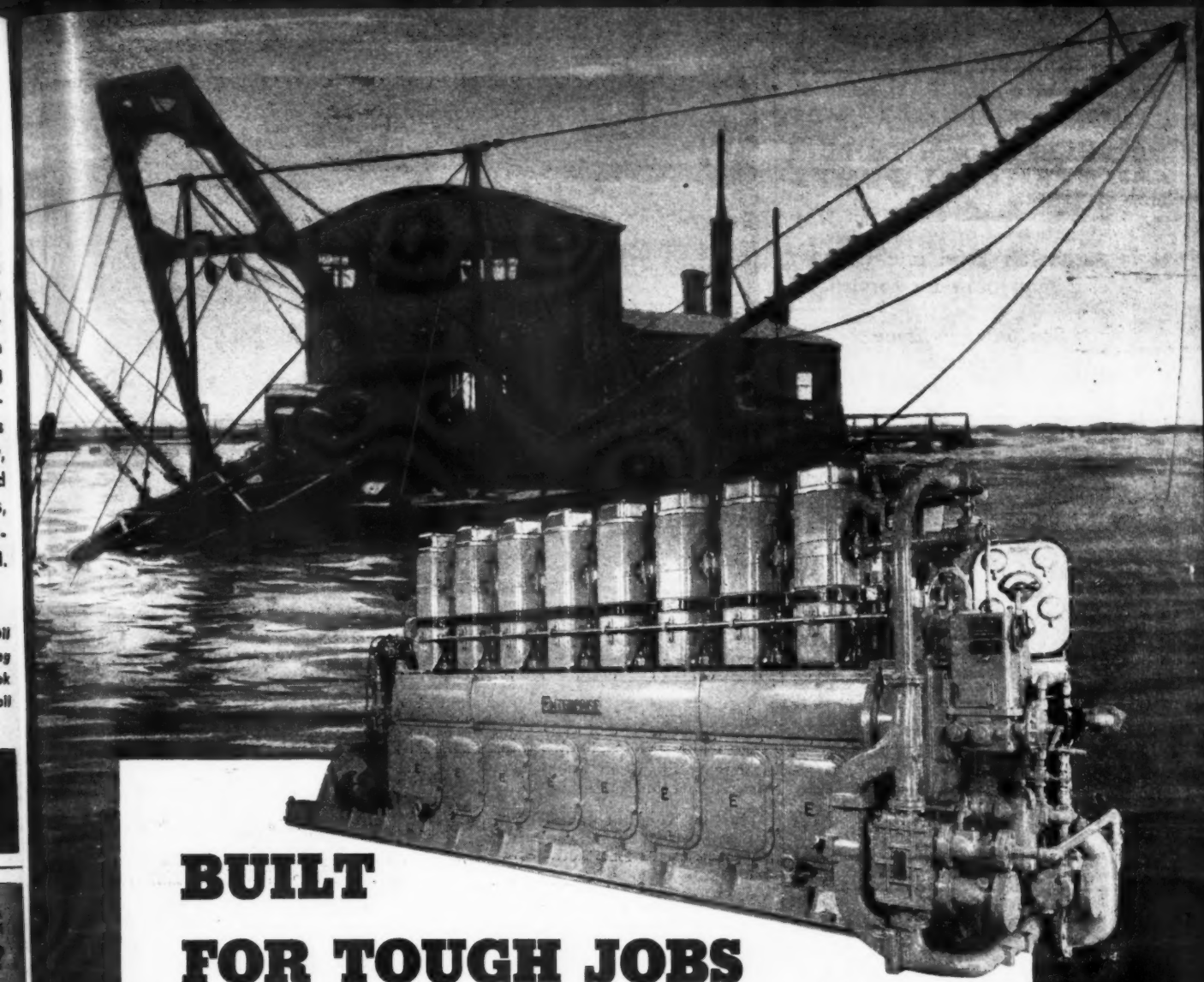

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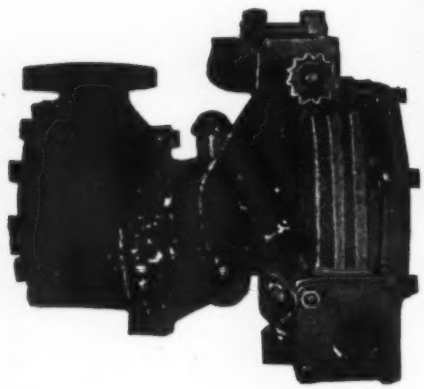

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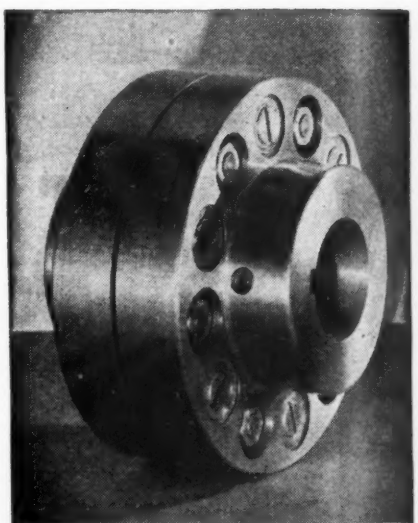

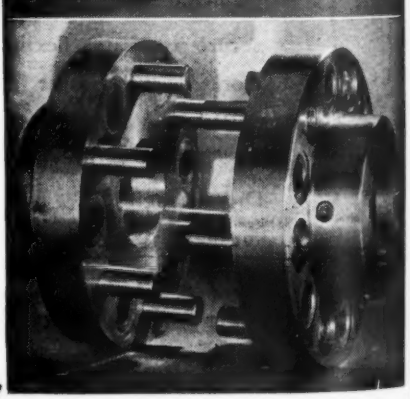

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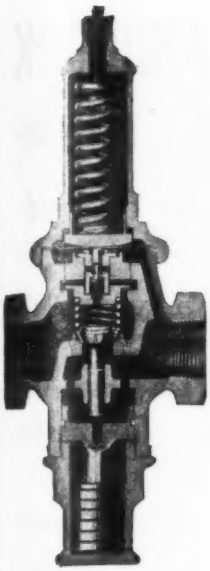

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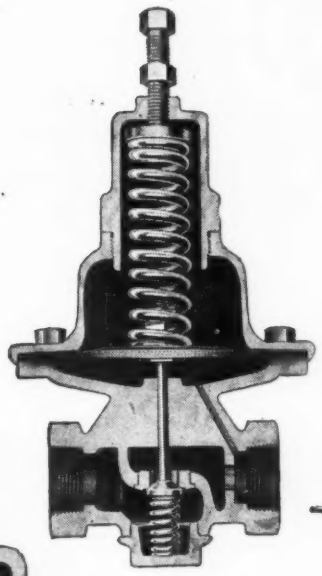

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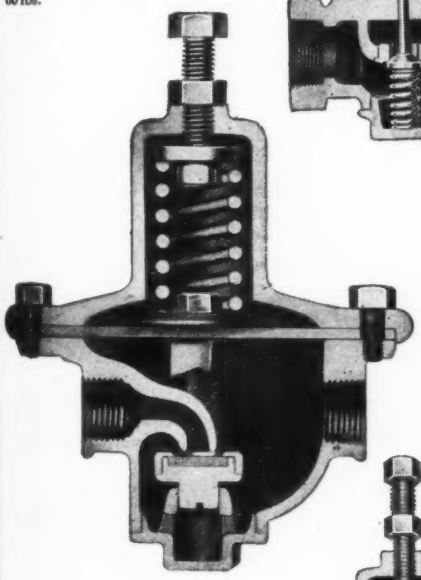

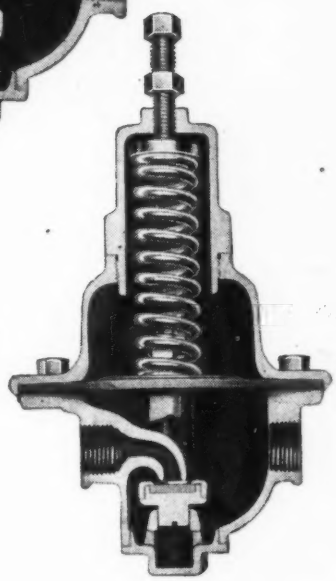

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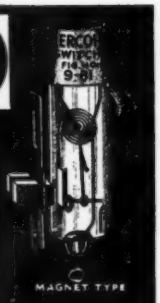

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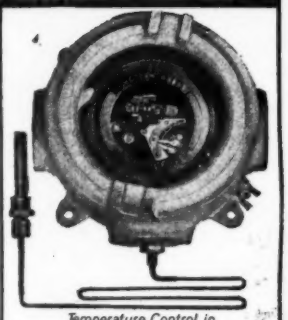

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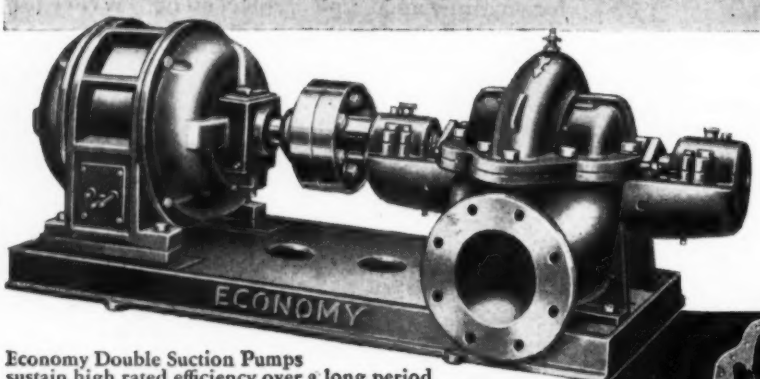

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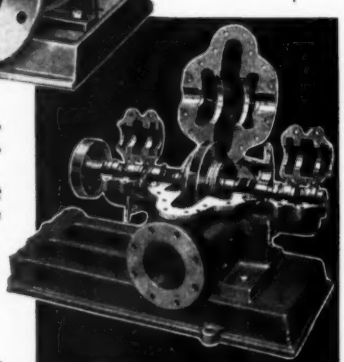

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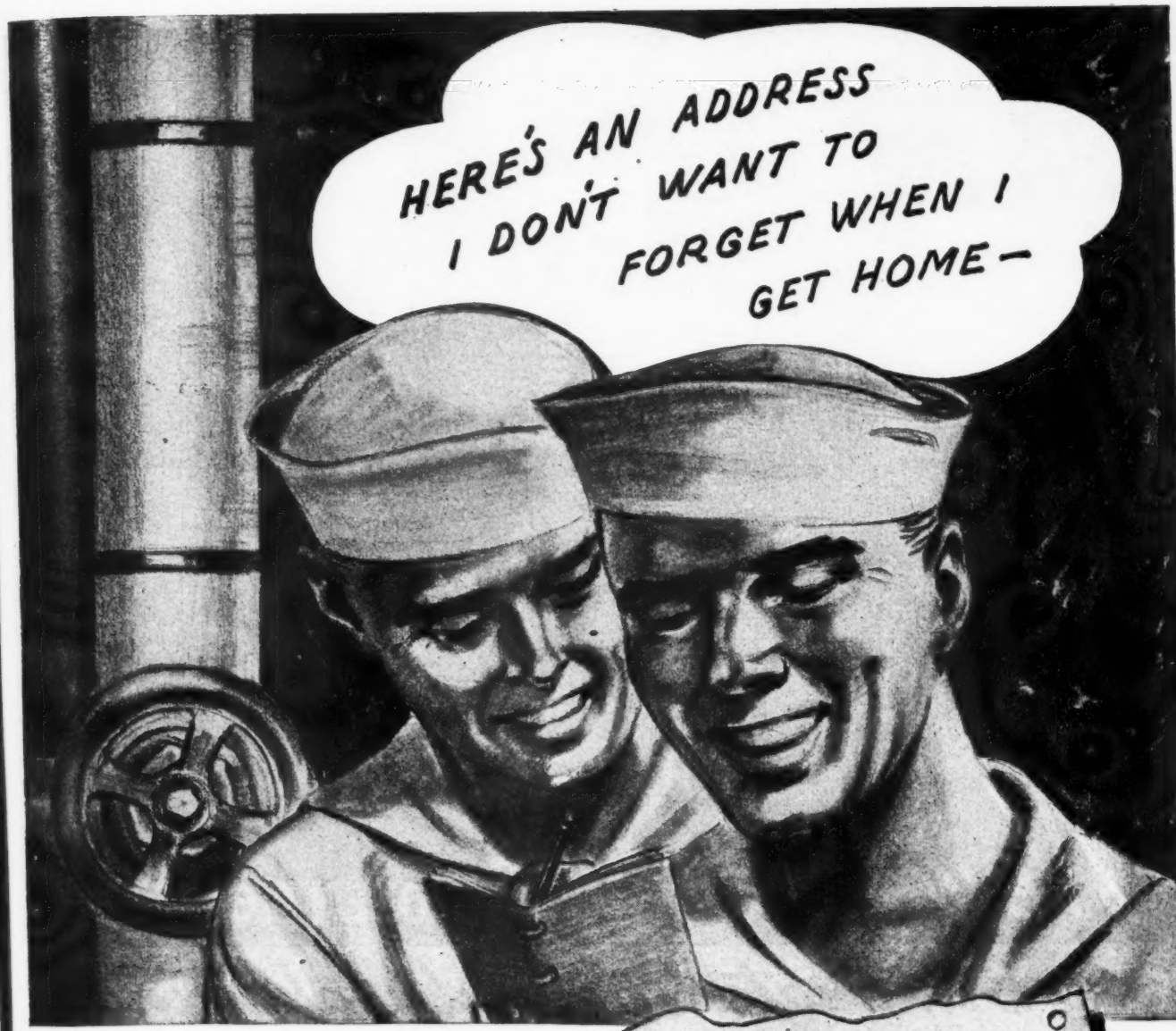

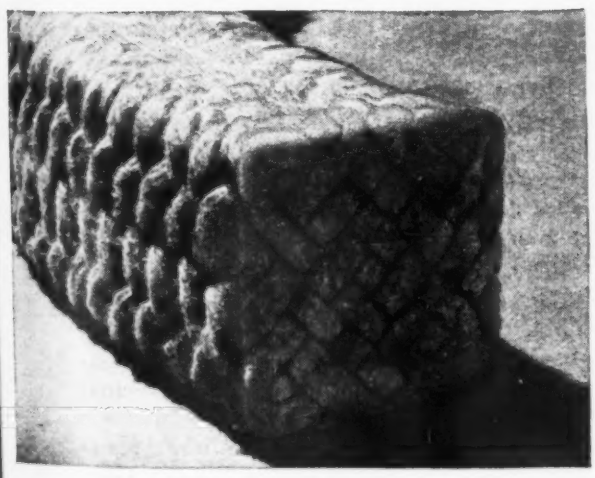

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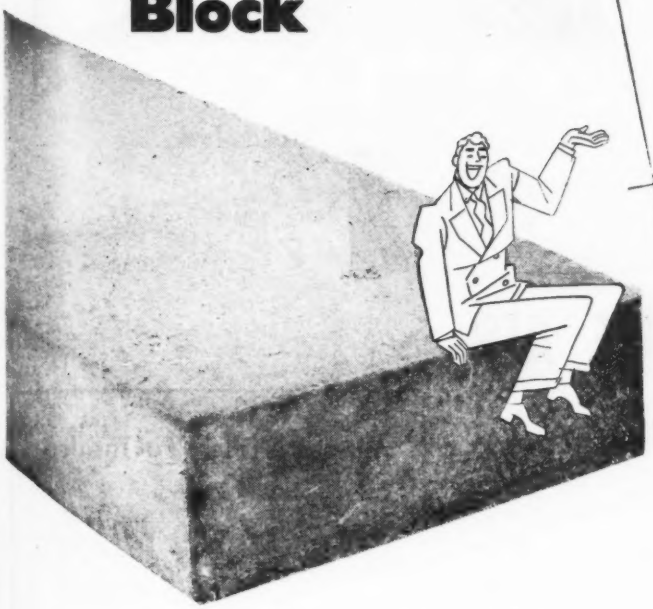
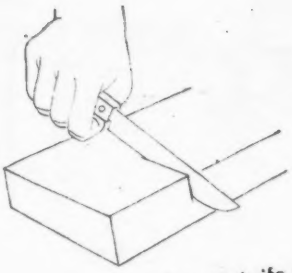
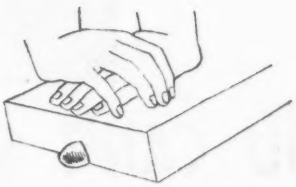
Supertemp Block





Cuts easily with knife or saw to fit irregularly shaped areas.



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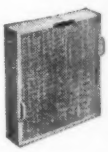
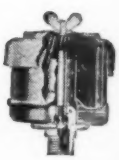


Engine intake air filter. Oil bath type.



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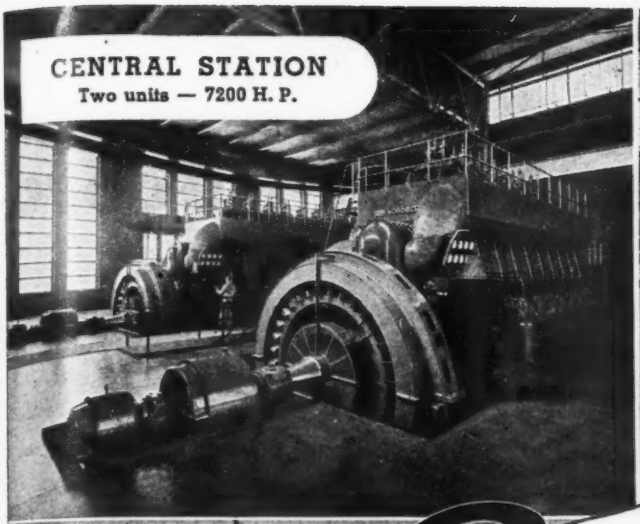

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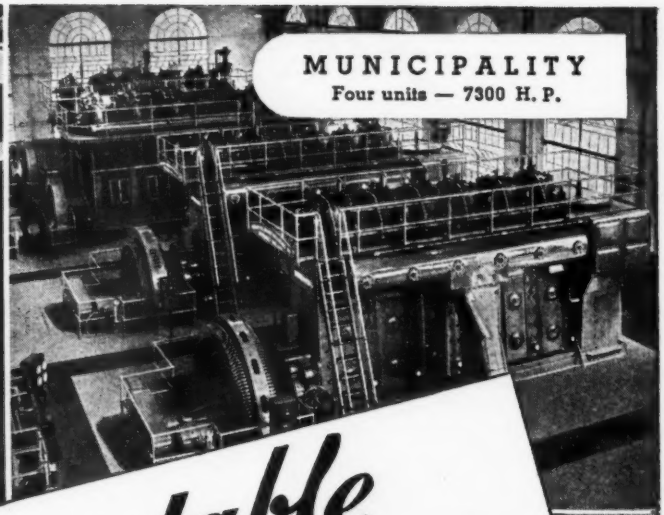

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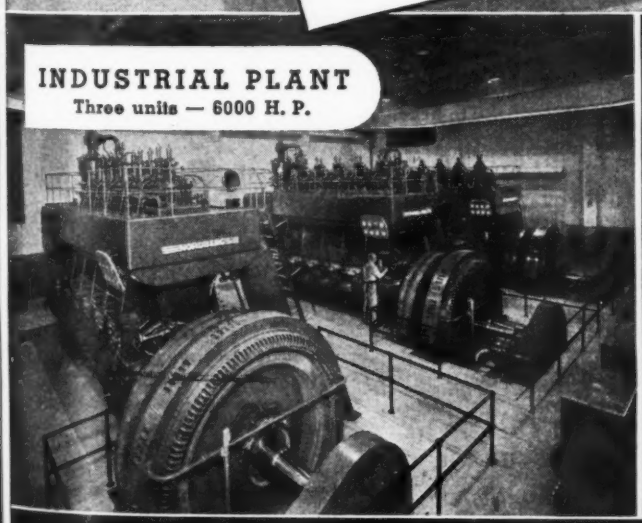
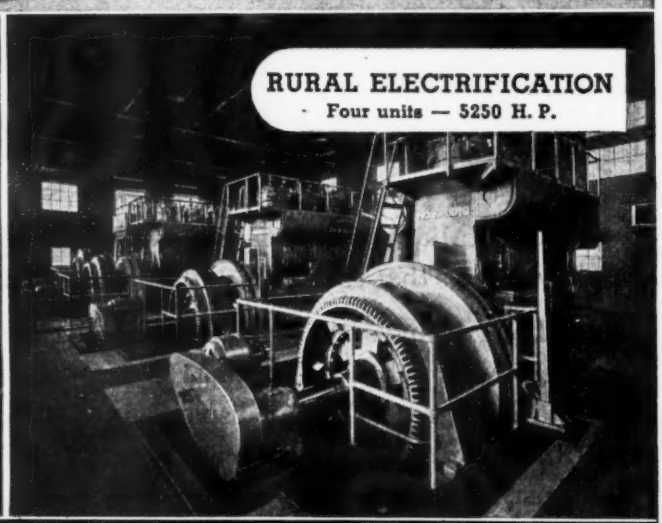
These are a few of the many applications for which Diesel engines are well suited. When engines are once more available for peacetime service, those in need of additional power will again be able to obtain dependable, low cost power through the use of Nordberg Diesels. Make your plans now for that modern Nordberg Diesel engined power plant to better meet your future requirements.

NORDBERG MFG. COMPANY • MILWAUKEE 7, WIS.



INDUSTRIAL PLANT
Three units — 6000 H. P.



RURAL ELECTRIFICATION
Four units — 5250 H. P.

NORDBERG
DIESEL ENGINES

First Baby Flat-Top Hangs Up a Great War Record

P. S. She is propelled by Busch-Sulzer Diesels

The Navy Department recently revealed that America's first escort aircraft carrier, the U. S. S. Long Island, had a part in the history-making victory at Midway. Its 'planes covered the operations of certain warships that turned back the Jap fleet bound for Hawaii.

The Long Island's appearance in the Pacific came after her pioneer work fighting U-boats. Her first air squadron, "composite one", recently was disbanded after receiving a presidential unit citation for having sunk, probably sunk or seriously damaged more enemy submarines than any other team in naval history, up to November 10, 1943.

With the easing of war demands, Busch-Sulzer will be able to step up rapidly its delivery of engines to peacetime customers without reconversion. Now is the time to decide what you need and assure yourself of early delivery. Please write us concerning your requirements.

BUSCH-SULZER BROS.–DIESEL ENGINE COMPANY · SAINT LOUIS

AMERICA'S OLDEST BUILDER OF DIESEL ENGINES

BUSCH-SULZER
ST. LOUIS

ROCKBESTOS A.V.C. likes it Hot!

Rockbestos A.V.C. 600 Volt Power Cable above, and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110°C. (230°F.) and this permanently insulated construction:

1. The conductor is perfectly and permanently centered in helically applied insulation.
2. Felted asbestos insulation, impregnated with heat-, flame-, and moisture-resisting compounds, withstands conductor heating overloads and won't dry out, bake brittle or burn.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat, flame and oxidation between two impregnated asbestos walls.
4. Outer felted asbestos wall, also impregnated with heat, flame and moisture resistant compounds, serves as an effective barrier against high ambient temperatures and flame.
5. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.

One of 122 different wires and cables developed for severe operating conditions by Rockbestos.

WON'T bake brittle, bloom, burn or rot.
RESISTS moisture, oil, grease and fumes.

ROCKBESTOS 600 VOLT A.V.C. CONTROL CABLE

In one to 19 conductors. Standard stranding AWG No. 12-19 #25 and No. 9-19 #22. Other strandings to specification.

Designed for use under conditions too severe for control cables with other types of insulation which deteriorate rapidly when exposed to high temperatures. Operates without failure under the attack of heat, oil, grease or corrosive fumes and may be installed in conduit as it has ample moisture resistance.

ROCKBESTOS 600 VOLT A.V.C. BOILER ROOM WIRE
(Underwriters' Type AVA)

Sizes No. 18 to 4/0 AWG. This construction for sizes 18 to 8, sizes 6 to 4/0 have another wall of felted asbestos next to the conductor.

For lighting and control circuits exposed to heat and moisture, oil, grease, corrosive fumes or fire hazard, such as exist around furnaces, ovens, lehrs, soaking pits, boilers, etc., this widely used A.V.C. construction is ideal. Its permanent insulation will not bake brittle, crack, rot, flow or swell.

BUY MORE WAR BONDS

Frequent rewiring jobs take time, cost money and slow down production. That's why it doesn't pay to take chances with wiring that runs around strip mills, soaking pits, forging presses, kilns, steam tunnels and other known trouble-spots.

Rockbestos A.V.C. takes the speculation out of wire performance in "hot-spot" circuits. Its *permanent asbestos insulation* stands up in operating temperatures up to 230 F°. without baking or cracking. It resists heat, flame, moisture, grease, oil and corrosive fumes and it won't rot, bloom, flow or swell.

For long, trouble-free performance in circuits exposed to severe operating conditions, install Rockbestos A.V.C. 122 standard constructions give you a wide range of selection.

When ordering or inquiring, please furnish CMP allotment number or symbol and certification. For complete information and samples, write nearest branch office or:

Rockbestos Products Corporation, 963 Nicoll Street
New Haven 4, Connecticut

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

CORAVOL★ *in your steam system frees you from* Pipe Repairs - Replacements - Lost Time - Costly Maintenance Labor - Production *and* Service Loss *due to* Shutdowns

CORAVOL★ (and only Coravol) saves you costly replacements, and hours or days of shutdown loss, because **CORAVOL** (1) prevents corrosion in steam and condensate lines, (2) cleans out clogging rust deposits resulting from previous corrosion. **CORAVOL** thereby increases the effectiveness of heat transfer surfaces; restores original capacity of lines and the operating efficiency of valves and traps.

CORAVOL is NOT a boiler feedwater treatment. When fed to the steam system, **CORAVOL** (a volatile and condensible liquid treatment for steam systems) *volatilizes* with the steam, *condenses* with the steam, and dissolves in the condensate. It does not remain in any one zone, but circulates throughout and protects *all* zones from corrosive attack. Only **CORAVOL** completely follows the steam-condensate circuit throughout the *entire* system.

★ And those products licensed for use under Western Chemical Company's basic patent.

For 7 years **CORAVOL** has proved its efficiency in hundreds of heating and steam power plants in more than 20 industries. Write today for complete data about the **CORAVOL** Process.

LINES CORAVOL BOILER

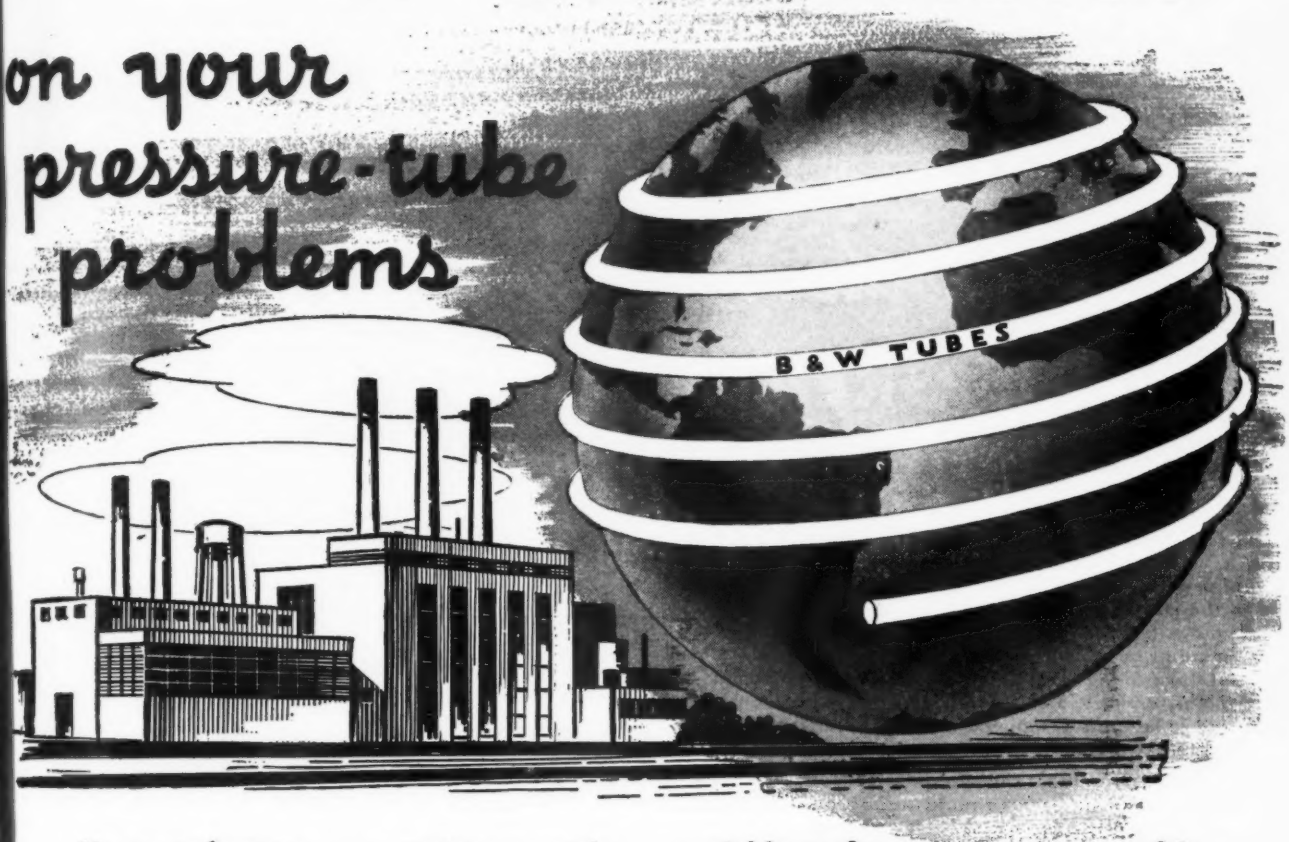
WESTERN CHEMICAL COMPANY

715 WASHINGTON STREET
KANSAS CITY 6, MISSOURI

54 Years of Know-How in the Chemical Treatment of Water

Get this 700 MILLION FEET OF EXPERIENCE . . .

on your pressure-tube problems



No manufacturer can produce enough pressure tubing to reach nearly 5½ times around the earth without acquiring a lot of valuable first-hand information on what it takes to match tubes to jobs for utmost dependability and economy under all kinds of operating conditions. This is just one way of measuring the experience that goes into the making and applying of every B&W Tube for steam generating and heat transfer equipment. It is reflected in their consistently uniform quality and dimensional accuracy and enviable performance service record in all types of equipment.

At B&W you get unbiased technical advice on pressure tubing requirements for B&W can furnish BOTH Seamless and Welded Tubes. In fact, nearly 20,000,000 feet of *welded* pressure tubing alone was supplied by B&W during the past 12 months.

Why not take advantage of B&W's wealth of experience, modern specialty tube mills and extensive research facilities next time you need pressure tubing?

B&W TUBES

ELECTRIC-RESISTANCE WELDED
Carbon steel grades
Sizes: ¾ in. to 4 in. O.D.

SEAMLESS
Complete range of carbon, alloy and stainless steels
Sizes: ½ in. to 8⅝ in. O.D

THE BABCOCK & WILCOX TUBE COMPANY

WELDED TUBE DIVISION
ALLIANCE, OHIO

SEAMLESS TUBE DIVISION
BEAVER FALLS, PA.

TA-1298

B&W MAKES BOTH

Atop the METHODIST HOSPITAL, the Health Beacon stands in majestic proportion in the skyline to remind every passerby that the Hospital is a haven of safety.

Like Another Endowment TO THIS GREAT HOSPITAL

SKINNER "UNIVERSAL UNAFLOW" STEAM ENGINES

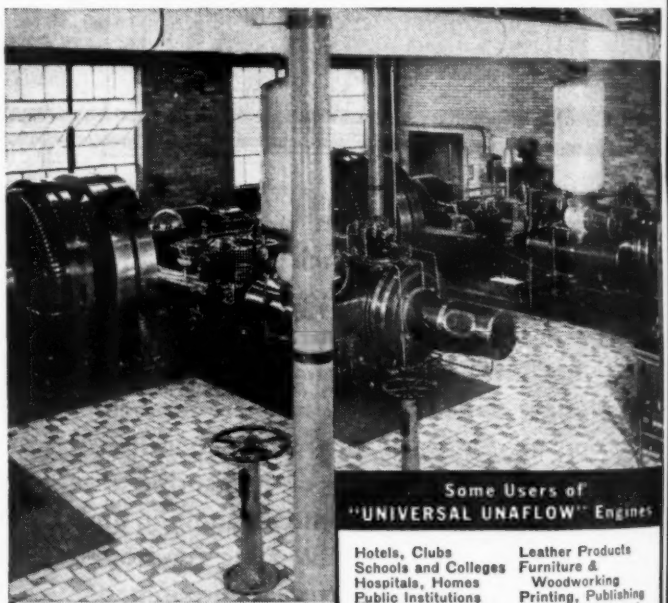
The METHODIST HOSPITAL stands in Indianapolis, a notable monument to the Hoosier citizens' spirit of devotion to science, philanthropy and religion. One of the largest and most complete institutions in the country, it serves as a model for other progressive communities to emulate. It has service facilities that rival those of the finest hotels—stores, restaurants, guest rooms, laundry, and the last word in scientific equipment in laboratories, operating rooms, and at the bedside of the patient.

It was only natural that those responsible for planning this great medical center should insist that it be as self-sufficient as possible, and to that end, that electric power be generated within the institution. Skinner "Universal Unaflow" Steam Engines were chosen because of their proven dependability and economy in hundreds of similar installations.

For the figures prove that an annual return of 150% on their actual investment is not unusual to many owners of Skinner Engine Power Plants—the savings being based on the cost of power generated by Skinner "Universal Unaflow" Engines in comparison with the cost of purchased power. Where can another endowment investment be found which will yield such returns?

At the METHODIST HOSPITAL, all energy for power and lights is generated by two Skinner "Universal Unaflow" Engine-Generator Units of 300-kw. and 200-kw. capacity respectively. A third unit of 300-kw. capacity is held in reserve. Exhaust steam from the engines is used for hot water and building heating purposes.

Such institutions as hospitals, hotels, laundries and office buildings, where there are requirements for considerable quantities of low-pressure steam, are everywhere finding in Skinner installations the answer to their search for economical power.



Part of METHODIST HOSPITAL engine room showing 300-kw. and 200-kw. "Universal Unaflow" engine-generator units.

Some Users of "UNIVERSAL UNAFLOW" Engines

Hotels, Clubs	Leather Products
Schools and Colleges	Furniture & Woodworking
Hospitals, Homes	Printing, Publishing
Public Institutions	Paper, Paperboard
Department Stores	Laundries, Cleaners
Office Buildings	Oil Refineries
Railroads	Stone and Brick
Meat Packing	Gas Plants
Dairies	Municipal Water & Electric Plants
Breweries	Cotton Oil Mills, Gins
Food Products	Rubber
Ice & Cold Storage	Glass
Mining	Bakeries
Chemical, Ordnance	Tobacco
Drugs and Soaps	
Machinery Mfrs.	
Textiles	

BUY *EXTRA* WAR BONDS

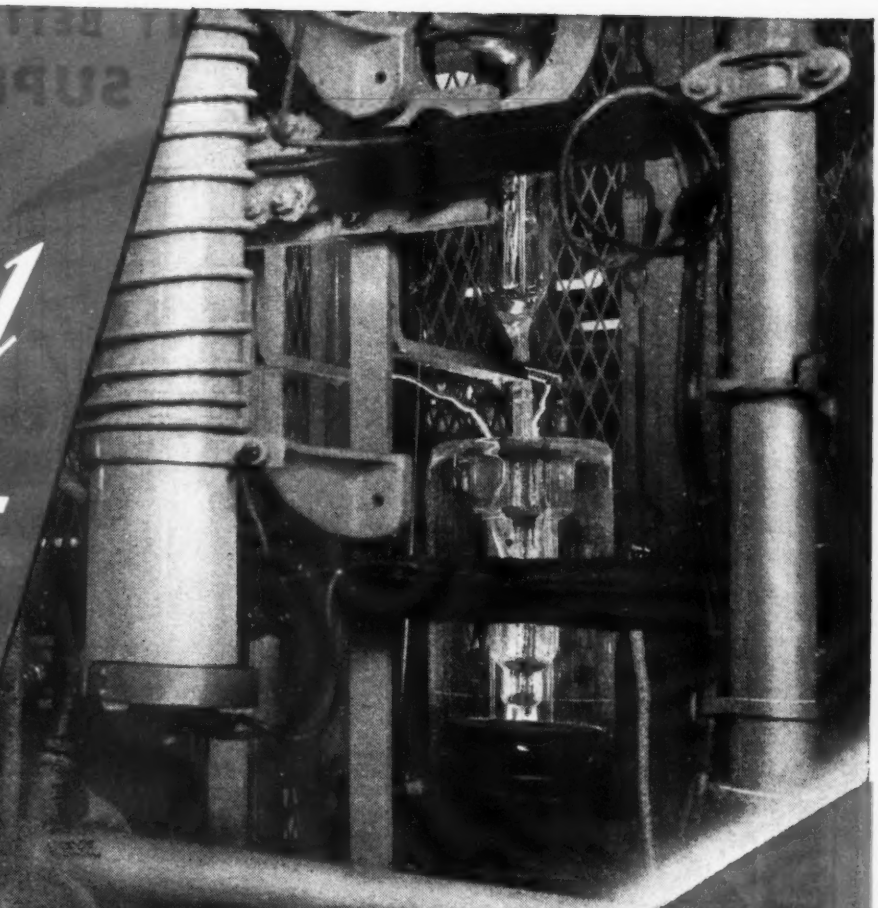
For Over 75 Years, Doing One Thing Well—Building Steam Engines

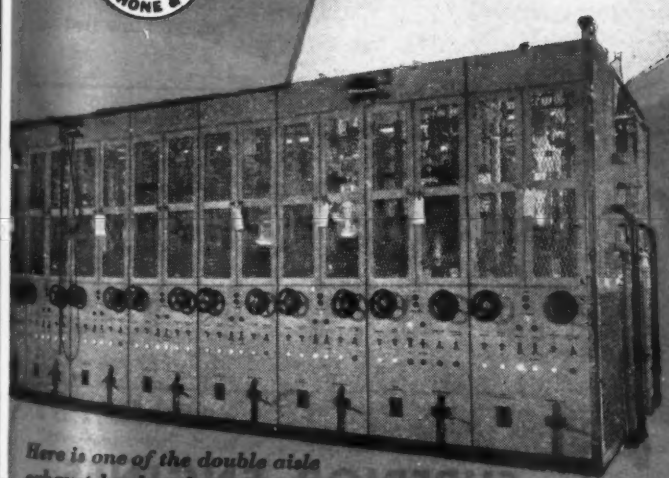
SKINNER ENGINE COMPANY, ERIE, PA.

Federal Tubes...

come CLOSER to the

PERFECT VACUUM





Here is one of the double aisle exhaust banks where 16 high power tubes can be exhausted at one time, each with individual control.

Always in the forefront of tube research and development, Federal makes another advance and now has added exhaust units of entirely new and original design to its production equipment.

This latest Federal achievement produces a tube that is substantially closer to the perfect vacuum—a tube with greater efficiency and longer life.

Arranged in banks of eight and operated with identical control equipment, these units exhaust uniformly every size of Federal tube—assuring a consistent and high standard of quality.

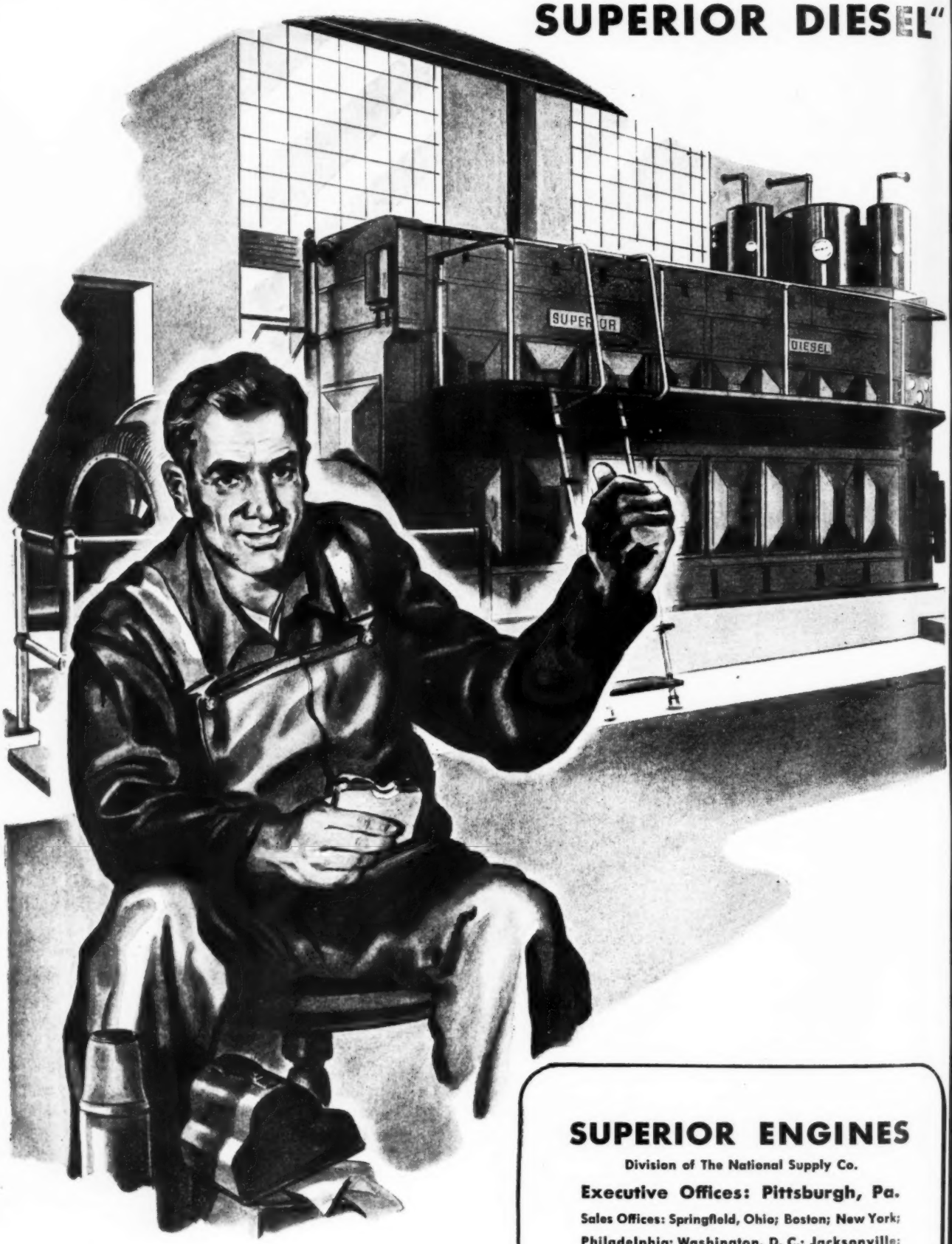
For any communication and industrial power tube need, turn to Federal now—test its reputation that "Federal always has made better tubes."

Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE

Newark 1, N. J.

"THEY DON'T MAKE 'EM ANY BETTER THAN SUPERIOR DIESEL"



Superior DIESELS • STATIONARY, 31 to 1200 H. P.

MARINE, 28 to 1200 H. P. • GENERATOR SETS, 12½ to 770 kw.

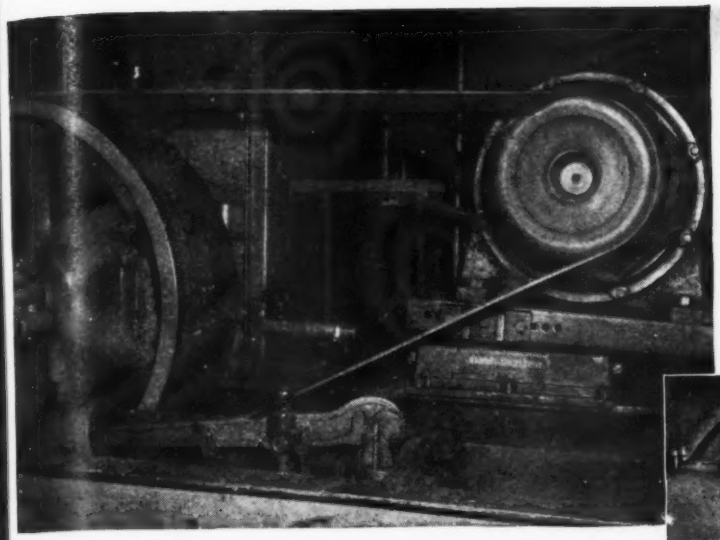
SUPERIOR ENGINES

Division of The National Supply Co.

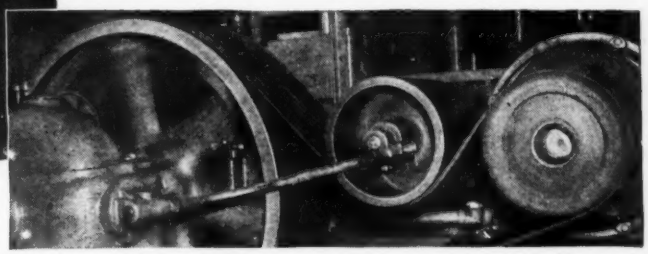
Executive Offices: Pittsburgh, Pa.

Sales Offices: Springfield, Ohio; Boston; New York; Philadelphia; Washington, D. C.; Jacksonville; Houston; Fort Worth; Tulsa; Los Angeles; Chicago.

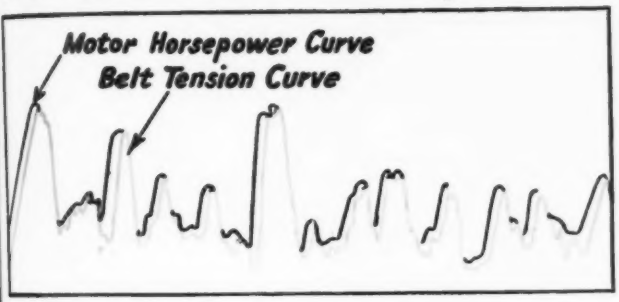
Factory: Springfield, Ohio.

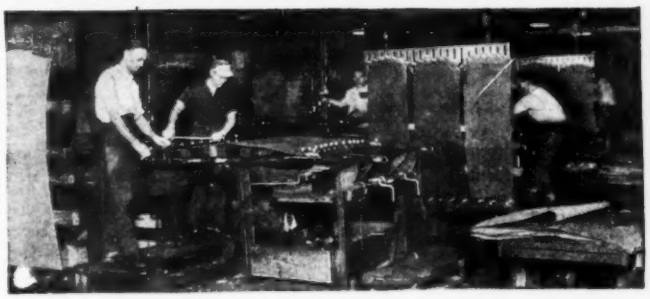


In this rubber plant, a leather belt replaced a rubber belt. On a compressor drive (48″ x 16″ pulley), the rubber belt, unsatisfactory, was replaced by a "Research" leather belt and the 100 HP, 870 R. P. M. motor (16″ x 16″ pulley) placed on a pivoted base. The gravity idler pulley which had caused trouble due to the idler arm bearing wearing and throwing the belt out of adjustment, was eliminated. The "Research" belt has required no servicing except for minor base adjustments.



No substitute can equal THIS . . . for short center drives





Put the motor on a pivoted base . . . belt the pulleys with a "Research" leather belt. The pivoted base will adjust belt tension automatically according to the load . . . saving unnecessary wear on belt and bearings. The flexible, high-friction "Research" belt will hug the small pulley with minimum slip and will take the continual flexing without excessive wear or waste of power. Will outlast a rubber V-belt on a corresponding drive by at least 2 to 1 . . . Shown above: G & K's exclusive prestretching according to hide characteristics, responsible for the non-stretch feature of "Research" belting.

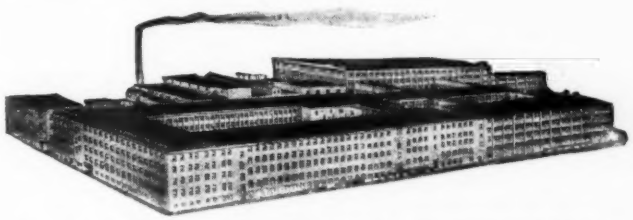
Extra Values from "Research" Belting's

"DOUBLE PLUS"

(all that's *better* in leather, made *best* in "Research")

- **MORE PRODUCTION** with leather belts because of leather's superior traction, which improves with age.
- **MOST PRODUCTION** with "Research" because "Research" processing adds extra pulley grip. 3% more production guaranteed.
- **LESS MAINTENANCE** with leather belts because natural "give-and-take" handles shock loads without undue strain.
- **LEAST MAINTENANCE** with "Research" because prestretching removes non-elastic stretch, saving take-ups.
- **LONGER LIFE** with leather belts because leather's tough, interlocking fibres have high resistance to both surface wear and internal friction.
- **LONGEST LIFE** with "Research" because the prestretched fibres are properly lubricated by precise, "weight-controlled" currying.

3% MORE PRODUCTION . . . 2 TO 4 TIMES LONGER LIFE . . . FROM "RESEARCH" BELTING'S DOUBLE PLUS



MORE UNIFORM results can be guaranteed because "Research" Belting is manufactured from green hide to finished belt under one roof, under one control, in the world's largest industrial leather plant.

The modern pivoted-base-flat-leather-belt is the most efficient, lowest-cost short center drive. Write 333 Franklin St., Worcester 4, Mass for "Short Center Book".

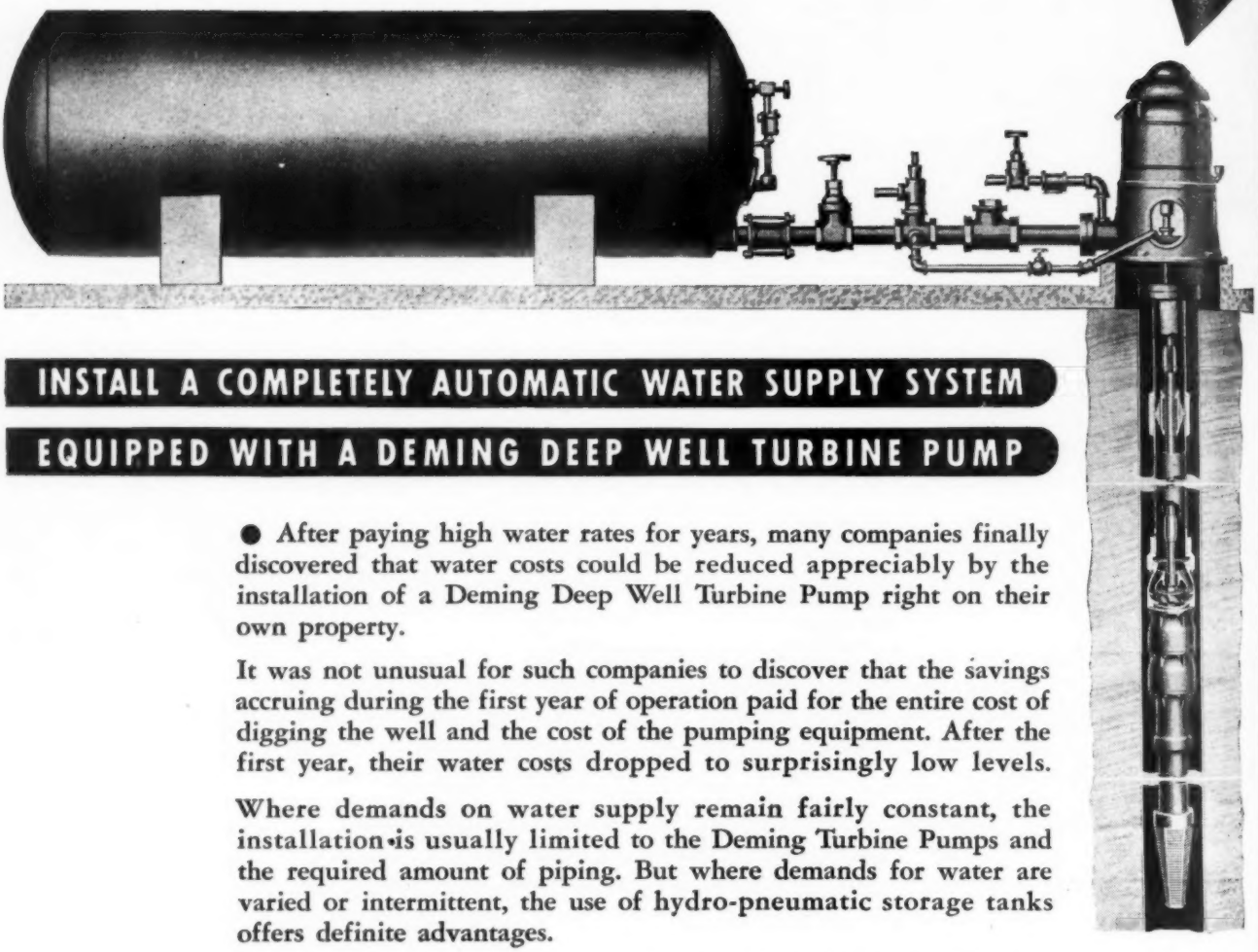
GRATON AND KNIGHT

"RESEARCH" BELTING

Graton & Knight Company, Worcester 4, Mass.

Branches and distributors everywhere. Look under "Graton & Knight" in "Belting" section of classified telephone directory or THOMAS' REGISTER.

Own Your Own Water Supply



INSTALL A COMPLETELY AUTOMATIC WATER SUPPLY SYSTEM

EQUIPPED WITH A DEMING DEEP WELL TURBINE PUMP

● After paying high water rates for years, many companies finally discovered that water costs could be reduced appreciably by the installation of a Deming Deep Well Turbine Pump right on their own property.

It was not unusual for such companies to discover that the savings accruing during the first year of operation paid for the entire cost of digging the well and the cost of the pumping equipment. After the first year, their water costs dropped to surprisingly low levels.

Where demands on water supply remain fairly constant, the installation is usually limited to the Deming Turbine Pumps and the required amount of piping. But where demands for water are varied or intermittent, the use of hydro-pneumatic storage tanks offers definite advantages.

Illustrated on this page is a typical type of installation comprising a Deming Deep Well Turbine Pump connected with a hydro-pneumatic storage tank.

If your company is interested in reducing water costs, consult the Deming Distributor in your area or communicate direct with The Deming Company, Salem, Ohio.

Complete details about advantages of Deming Deep Well Turbine Pumps are available in BULLETIN 4700-8. A copy will be forwarded to you promptly upon request.

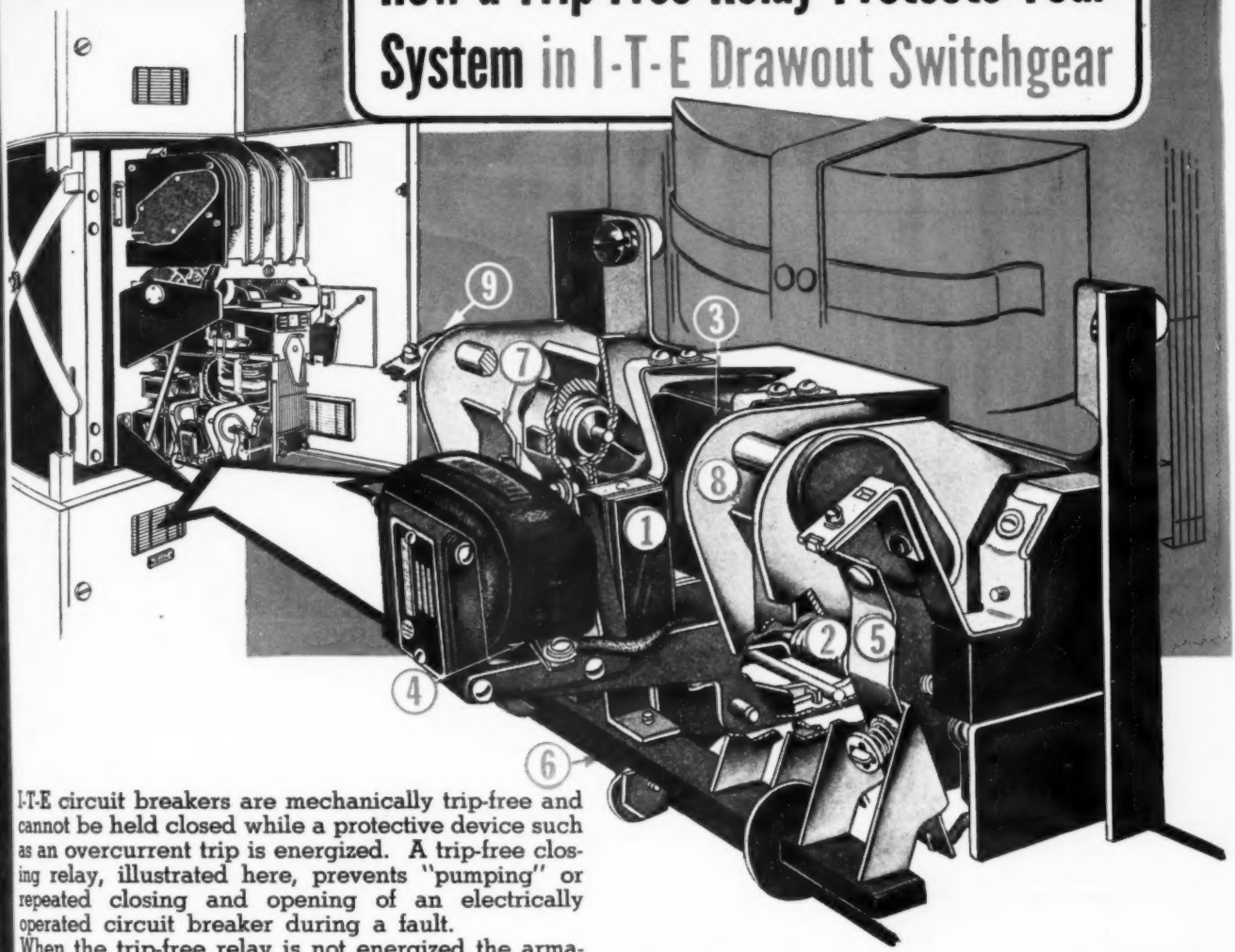
DEMING

THE COMPLETE LINE

PUMPS AND WATER SYSTEMS

The Deming Company · Salem, Ohio

How a Trip-Free Relay Protects Your System in I-T-E Drawout Switchgear



I-T-E circuit breakers are mechanically trip-free and cannot be held closed while a protective device such as an overcurrent trip is energized. A trip-free closing relay, illustrated here, prevents "pumping" or repeated closing and opening of an electrically operated circuit breaker during a fault.

When the trip-free relay is not energized the armature (1) is held by spring (2) in a central position between the magnet pole faces of the pickup coil (3) and the hold-open coil (4). Auxiliary contact (5) is closed.

When the control switch is operated both coil (3) and coil (4) are energized. The magnet energized by coil (3) is the more powerful and attracts armature (1). The movement of the armature rotates the operating shaft (6) and closes the main contacts (7) and (8). This completes the circuit breaker closing coil circuit, the coil is energized and the breaker closes. When the breaker closes, an auxiliary switch connected to the circuit breaker closing mechanism opens the circuit through coil (3). Coil (4) is still energized and its magnet attracts armature (1), rotating shaft (6) and opening the main contacts (3) and (4) and the auxiliary contact (5).

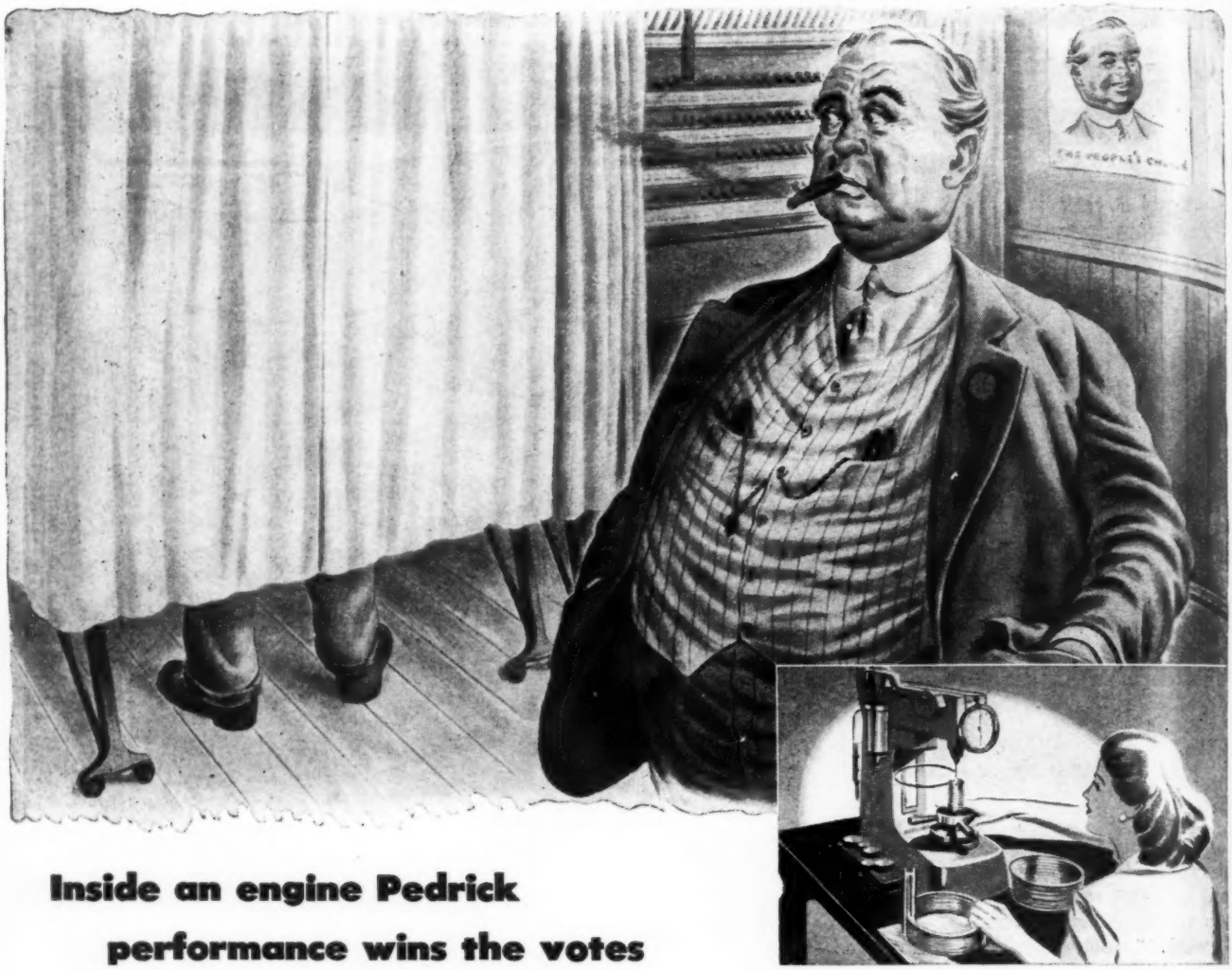
If the control switch is a type that remains closed, such as a float switch, auxiliary contact (5) is wired in series with closing coil (3) and the auxiliary switch and keeps the pickup coil circuit open after the resetting of the mechanism causes the auxiliary switch to reclose. Another auxiliary contact (9) is available for such services as interlocking. Both auxiliary contacts are reversible and may be made either circuit opening or circuit closing.

The purpose of identifying the essential parts of an I-T-E trip-free relay and of describing their function is to offer an example—a foretaste—of I-T-E's willingness to give complete data whenever switchgear is to be planned or specified as new equipment or changed to meet new conditions. From or through the I-T-E representative nearest you, you can have all the helpful information your problem requires. Much of the information is available with illustrations of the kind shown above, prepared with the thought of saving your time and of indicating the care given by I-T-E in design and construction. Ask your representative or write to I-T-E Circuit Breaker Company, 19th & Hamilton Streets, Philadelphia 30, Pa.

Representatives in Principal Cities

I-T-E AIR SWITCHGEAR

It's what goes on INSIDE *that counts*



Inside an engine Pedrick performance wins the votes

TRUE SHAPE...absolute flatness...life-long tension... these are the important characteristics in Pedrick piston rings that assure top performance for every job they are elected to do. They mean extra fuel and oil savings, more power, and longer life for each installation.

Pedrick piston rings are so accurately shaped that a light-test shows them to bear evenly against the cylinder wall all the way around. They are so flat that rings 2 inches in diameter can be stacked 6 feet high without wavering. Their life-long tension is accomplished through an exclusive, patented, Heat-Shaping process that fixes exactly the right amount of tension around the entire circumference of the ring.

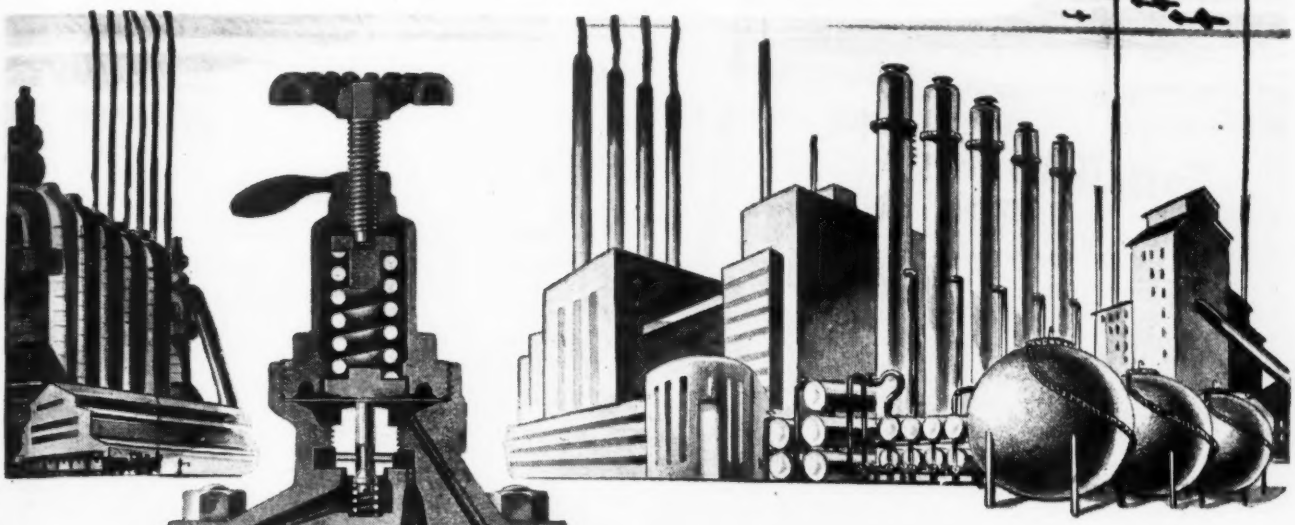
Pedrick *precisioneered* piston rings in all kinds of Diesels, compressors, pumps, and hydraulic equipment, assure increased compression and power, with less time out for repairs. Remember, it's what goes on *inside* that counts. WILKENING MANUFACTURING CO., Philadelphia 42, Pa. *In Canada:* Wilkening Manufacturing Co. (Canada), Ltd., Toronto.

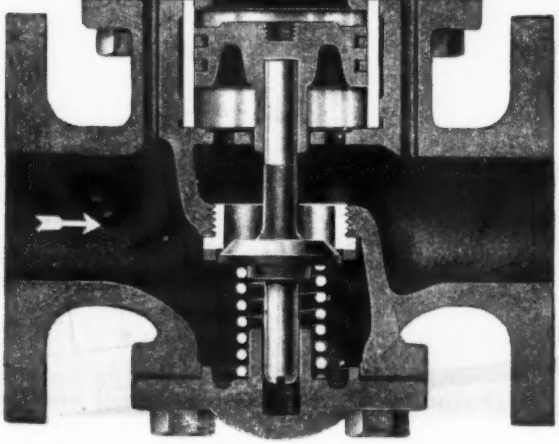
Pedrick

precisioneered **PISTON RINGS**

SPEND LESS — LEND MORE
BUY WAR BONDS TODAY

TODAY, INDUSTRY NEEDS THIS BETTER PRESSURE REDUCING VALVE





GREATER SENSITIVITY Auxiliary valve stem machined to .0005" tolerance, eliminating stuffing boxes that retard response or cause leakage. Steam ports drained to prevent collection of condensate.

LONGER SERVICE LIFE. Valves and seats Stellited and surface hardened to 600-800 Brinell — diaphragm and springs of special fatigue resistant alloys.

ACCURATE & RUGGED—Although there are many pressure reducing valves on the market, certain industries need a valve of extreme accuracy and sensitivity, together with ordinarily unobtainable ruggedness. After-war competition will place more manufacturers in this position. For such customers, Leslie Pressure Reducing Valves are indispensable. A Navy standard for 40 years, these valves find extensive use in the industrial, railroad and maritime fields

SELF-CONTAINED & FULLY AUTOMATIC—Being of the spring-loaded internal pilot, piston-operated type, first developed and further improved by Leslie Co., these valves are unaffected by inlet pressure fluctuations. They do not "hunt" or overcontrol, and thus do not waste steam or endanger processes as "open and shut" or lagging controllers do. They respond smoothly and quickly to load changes from full capacity to "dead-end" shut-off.

Available in bronze body construction and guaranteed for pressures up to 300 p.s.i. and temperatures to 550 degrees F., or in cast steel for pressures up to 600 p.s.i. and temperatures to 750 degrees F.

ESTABLISHED 1903

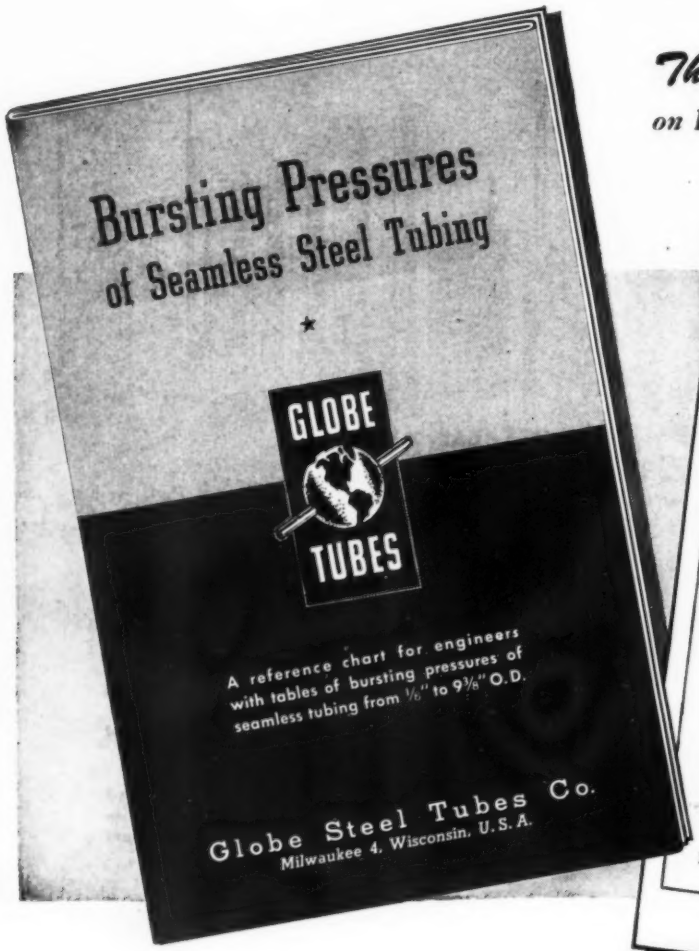
LESLIE

REGULATING VALVES
LESLIE-TYFON WHISTLES

LESLIE CO., LYNDHURST, NEW JERSEY

Of Interest to Engineers and other Technical Men

This Valuable Reference Bulletin
on Bursting pressures of Seamless Steel Tubing.


Bursting Pressures
of Seamless Steel Tubing
★
GLOBE
TUBES
A reference chart for engineers with tables of bursting pressures of seamless tubing from ⅛" to 9⅜" O.D.
Globe Steel Tubes Co.
Milwaukee 4, Wisconsin, U.S.A.

Bursting Pressure of Seamless Tubing as Determined by Barlow's Formula for a Stress of 10,000 lbs. p.s.i.

Wall Thickness		Outside Diameter in Inches							
B. W. G.	Inches	⅛	5/32	3/16	7/32	¼	9/32	5/16	11/32
24	.022	3520	2816	2347	2011	1760	1564	1408	1280
23	.025	4000	3200	2667	2286	2000	1778	1600	1455
22	.028	4480	3584	2987	2560	2240	1991	1792	1629
21	.032	5120	4096	3413	2926	2560	2276	2048	1862
20	.035	5600	4480	3733	3200	2800	2489	2240	2036
19	.042	6720	5376	4480	3840	3360	2987	2688	2444
18	.049	....	....	5227	4480	3920	3484	3136	2851
17	.058	....	....	6187	5303	4640	4124	3712	3375
16	1/16	....	....	6667	5714	5000	4444	4000	3642
	.065	....	....	6933	5943	5200	4622	4160	3782
15	.072	....	....	....	....	5760	5120	4608	4189
14	.083	....	....	....	....	6640	5902	5312	4829
13	3/32	....	....	....	....	7500	6667	6000	5455
12	.095	....	....	....	....	7600	6756	6080	5527
11	.109	....	....	....	....	....	....	6976	6342
	.120	....	....	....	....	....	....	7680	6982

Here is excellent data for engineers and technical men who deal with boiler, still, condenser and heat exchanger tubing and other pressure tubing.

The 24-page booklet contains 16 pages of calculations on tubes in sizes from ⅛" to 9⅜", outside diameters, and wall thicknesses from 24-gauge to 1½", and a full explanation of the method used in calculating the pressures.

A copy of this informative bulletin is yours for the asking. Write for copy of Bulletin 112 today.

★ STAINLESS TUBES
★ BOILER TUBES
★ GLOBEIRON TUBING
★ GLOWELD TUBES

GLOBE TUBES

★ CONDENSER AND HEAT EXCHANGER TUBES
★ MECHANICAL TUBING

GLOBE STEEL *Tubes*

5013

GLOBE STEEL TUBES CO., *Milwaukee 4, Wis., U.S.A.*

LIQUID LEVEL TARGET *for* EYES

OUTSTANDING FEATURES

Eye Level Readings of boiler water or other liquid levels on instrument panel or other convenient location.

•

Instant, Accurate Indication —a positive check on remote, hard-to-see liquid level gages.

•

Operated by the boiler water —itself. "Positive as the law of gravity."

•

No stuffing boxes. Frictionless Mechanism — Jewelled Bearings.

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Indicating mechanism never under pressure. Magnetic transmission between actuating and indicating mechanism.

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Indicates in full or reduced scale. Up to 8 ft. level variation.

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Compact—Moderately Priced. Available for all pressures up to 1500 lb.

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Easily Installed on new or existing equipment.

Now, stop squinting and guessing at boiler water levels. End the risk of serious damage to important equipment. Keep accurate check on other liquid levels in your plant.

With the Yarway Remote Liquid Level Indicator—"the Eyes have it" all the time, right in front of them—on instrument panel or wall, wherever it's most convenient and prominent. Quick, accurate, eye-level readings regardless of location of the levels to be checked.

Hundreds in Use

Read the features listed at the left. Facts that have already influenced the purchase of hundreds of Yarway Instruments for utilities, industrial plants, institutions and marine service.

And everywhere, use has multiplied satisfaction with this positive, accurate, dependable, *popularly-priced instrument.*

A Development of the Yarway Steam Laboratory

The Yarway Remote Liquid Level Indicator is another development of the unique Yarway Steam Laboratory, responsible for all new Yarway products and improvements. Here, a device must be right or it never meets the public. For instance, for the past three years, an accelerated endurance test has been carried out on a standard stock Yarway Indicator. In continuous operation, day and night, under rapidly-changing liquid levels that produced full pointer travel, the mechanism has operated through 17 million complete travel cycles —equivalent to 50 years of ordinary boiler room service, with no repairs, replacements of parts or change in calibration.

Why not get this positive, dependable, convenient indication of the liquid levels in your plant?

For further information, write for Bulletin WG-1820.

YARNALL-WARING COMPANY · 100 Mermaid Ave., Phila. 18, Pa.

YARWAY REMOTE LIQUID LEVEL INDICATOR

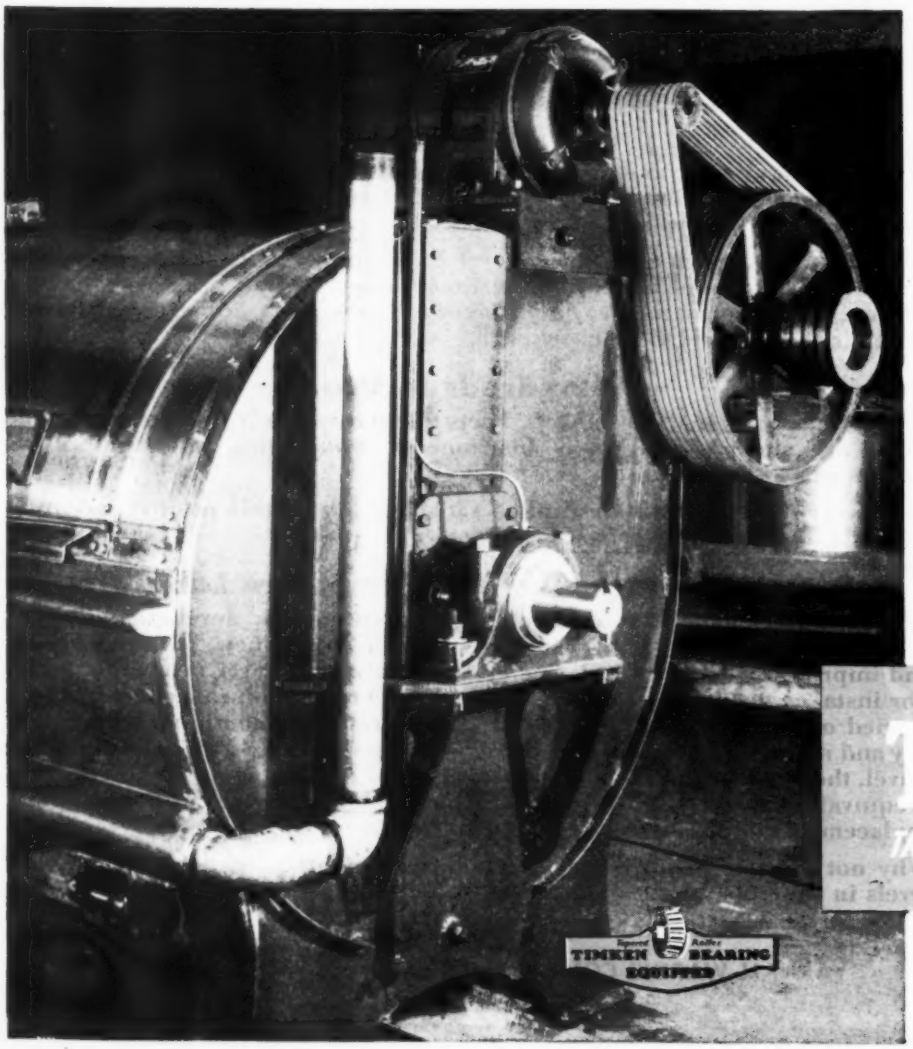
Dodge-Timken *Power Savers at work*

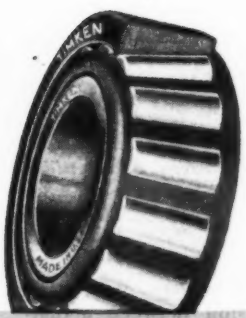
This Miller Two Compartment Double End Washer is merely one of thousands of examples of the power-saving properties of Dodge Pillow Blocks equipped with Timken Bearings. The guard cover has been removed to show the Dodge-Timken Double Interlock Pillow Blocks.

The manufacturers of these washers know that power is too precious to be wasted — burned up by obsolete friction-bearing transmission equipment; and so do the makers of industrial equipment of every kind — and the people who use it.

Timken Bearings are more than power savers however; they prevent wear on shafts; give full protection against radial, thrust and combined loads; hold moving parts in constant alignment; simplify lubrication and save lubricant; and thereby help to prevent involuntary power interruptions.

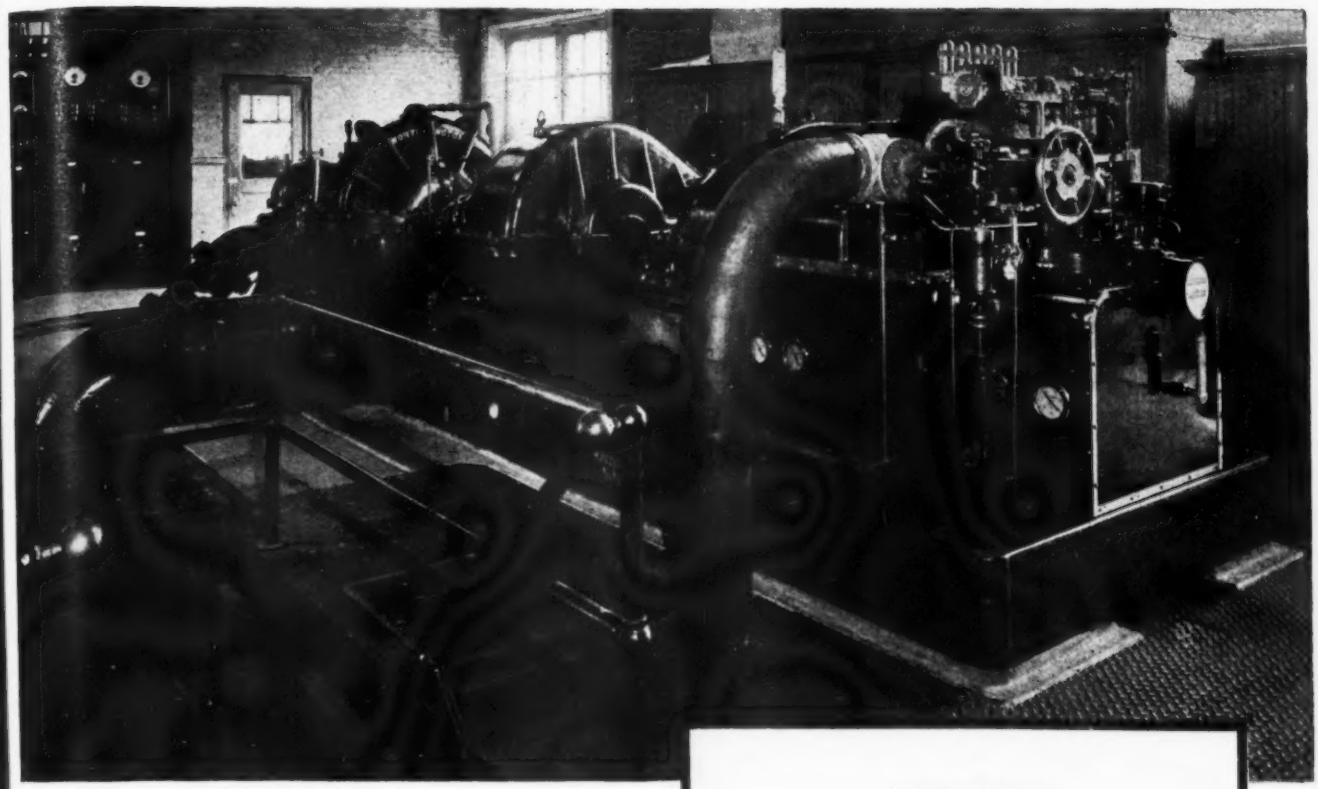
Is your power transmission equipment saving or wasting power? It will pay you to find out *now*. The Timken Roller Bearing Company, Canton 6, Ohio.





TIMKEN
TAPERED ROLLER BEARINGS

COMPLETE UNIT RESPONSIBILITY



THIS Worthington-Moore turbine-driven centrifugal pumping unit was installed by the Water Works Department of the City of Lansing, Michigan, in 1941.

Turbine, gear, main pump, condenser and auxiliaries were engineered as a unit for maximum efficiency and uninterrupted service.

A Worthington-Moore condensing steam turbine, with double-helical reduction gear, drives a Worthington centrifugal pump capable of delivering 20 million gallons per day against discharge head of 200 feet.

Worthington—world's largest manufacturer of pumps, with broad experience in steam power equipment—combined with Moore's years of turbine engineering, can build the same year-in, year-out, trouble-free service into *your* Worthington-Moore steam turbines. Write us. Worthington Pump and Machinery Corporation, Moore Steam Turbine Division, Wellsville, N. Y.

ADAPTABLE TO HIGHER STEAM PRESSURES

Now operating on steam at 160 lbs. pressure, exhausting to 29" vacuum, the construction of Lansing's Worthington-Moore turbine is suitable for future steam conditions of 400 lbs. pressure and 750°F. total temperature. Automatic nozzle control permits greatest efficiency at reduced pumping rates.

WORTHINGTON PUMP AND MACHINERY CORPORATION
HARRISON, NEW JERSEY
MOORE STEAM TURBINE DIVISION, WELLSVILLE, NEW YORK

WORTHINGTON

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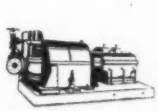
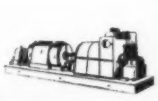
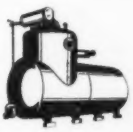
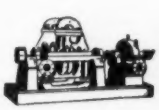
MR4-4

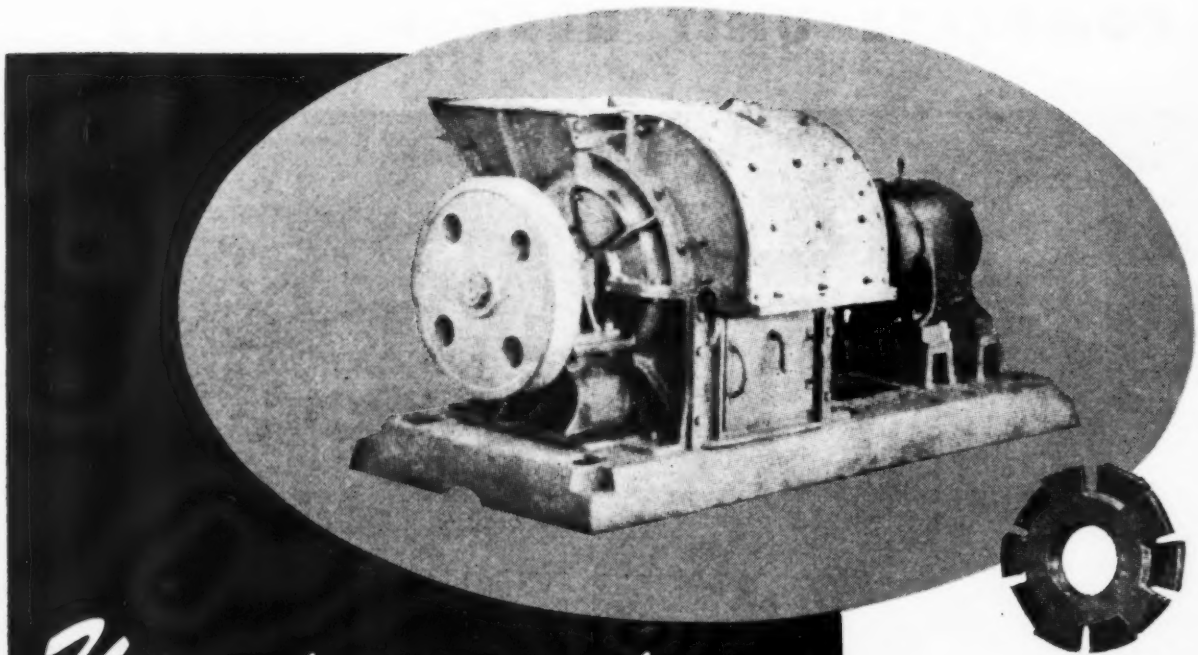




A GREAT TEAM IN STEAM







You can't improve the coal but—

YOU CAN IMPROVE THE CRUSHING

INVESTIGATE THE "AMERICAN WAY"

Power engineers will do well to recognize the inevitable fact that available coals in the future will be difficult-to-prepare coals — and then take steps to meet the situation.

One important way to handle the problem is to explore the possibilities of the AMERICAN RING CRUSHER as the means of insuring proper coal preparation of the coals that will be available. By so doing, you'll find you can avoid difficulties later when your prospective coal supply becomes a real issue.

In order to assist you in your investigation, ask us to refer you to plants that have already installed the "AMERICAN WAY." Let us give you facts and figures on coal preparation costs— the kinds of coal that are prepared for stoker and pulverized fuel firing — and how the AMERICAN RING CRUSHER will give you exactly the degree of fineness for your conditions and for maximum combustion efficiency.

AMERICAN RING CRUSHERS are helping many leading plants attain high performance on a wide range of available coals. They can render a valuable service to you, too. Investigate NOW!

•

Write for a copy of one 8-page Bulletin "Crushing Coal at Less Than One Cent Per Ton." Free on request.

COAL IS SPLIT— NOT CRUSHED

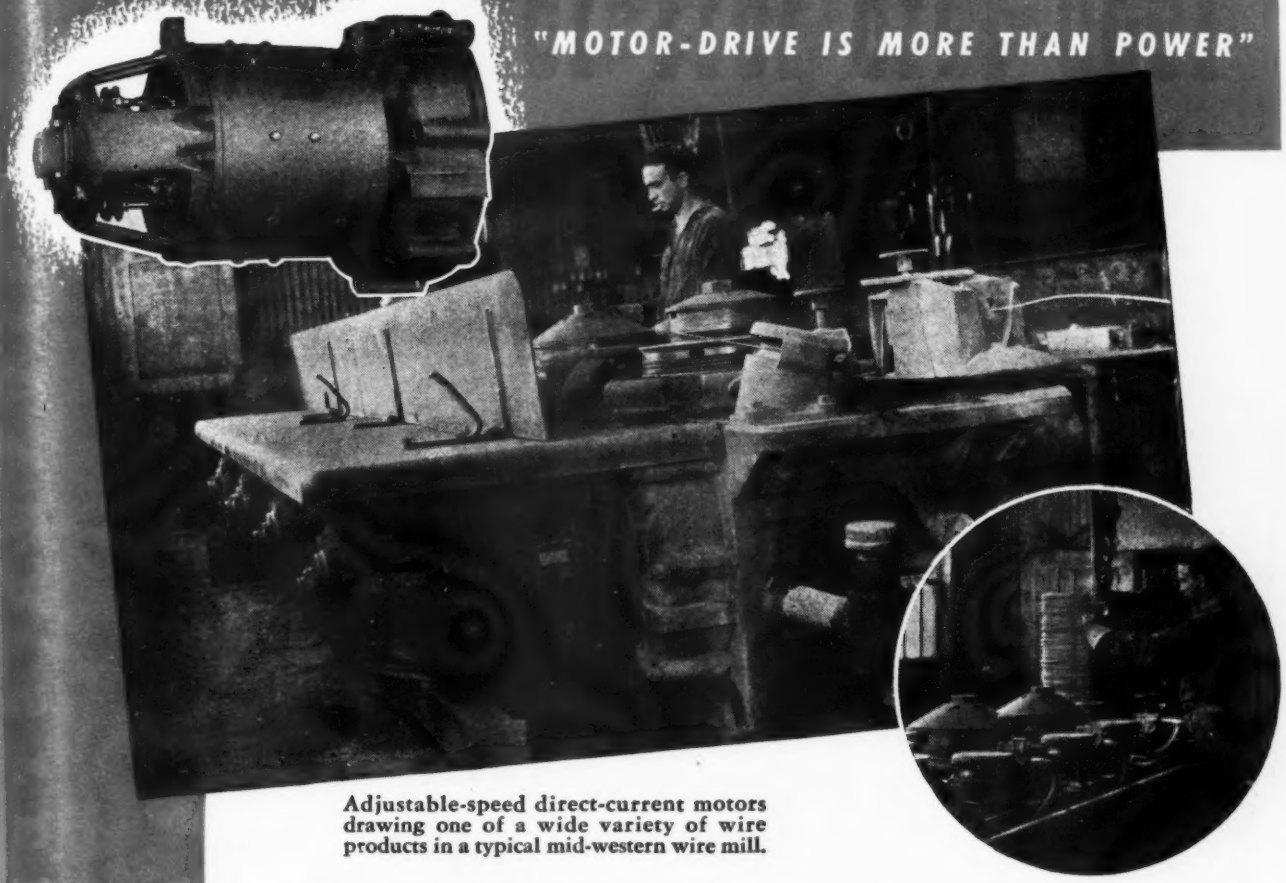
Manganese Steel Shredder Rings—like the one shown above, are employed in the "AMERICAN" to split the coal and prevent clogging. Each ring has 20 cutting edges or teeth and is free to swing by centrifugal force.

The grinding plate of the "AMERICAN" is adjustable, so that size of finished product can be varied. Adjustment can be made while crusher is in operation.

AMERICAN PULVERIZER COMPANY 1349 MACKLIND AVENUE ST. LOUIS 10, MISSOURI

ORIGINATORS AND MANUFACTURERS OF RING CRUSHERS AND PULVERIZERS

"MOTOR-DRIVE IS MORE THAN POWER"



Adjustable-speed direct-current motors drawing one of a wide variety of wire products in a typical mid-western wire mill.

PRODUCTION SPEEDED

with added flexibility and safety...

This particular application of Reliance Motor-drive is in a wire-drawing mill. But the basic idea it emphasizes—*that motor-drive is MORE than power*—can be used in many ways, practically anywhere that motor-driven machinery is employed.

Taking advantage of features inherent in the electric motor, the designers and users of wire-drawing machines have stepped up drawing speeds to double and triple those previously thought possible, and the new methods making use of Reliance Motor-drive are more flexible, better adapted to variations in production schedules and far safer.

Reliance men are always glad to place their specialized knowledge of electric motor-drive at the service of design or production engineers. This kind of teamwork frequently saves much planning and designing time and produces highly satisfactory results. Just write or phone the nearest Reliance office if you're interested.

RELIANCE ELECTRIC & ENGINEERING COMPANY
1088 Ivanhoe Road • Cleveland 10, Ohio

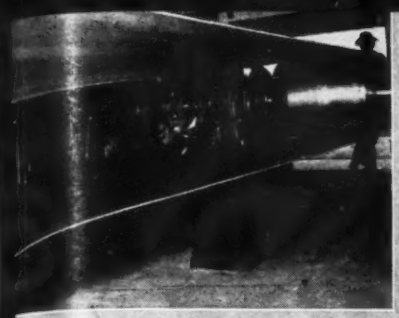
Birmingham • Boston • Buffalo • Chicago • Cincinnati • Detroit • Greenville (S.C.) • Houston • Los Angeles • Minneapolis • New York Philadelphia • Pittsburgh • Portland (Ore.) • St. Louis • Salt Lake City • San Francisco • Syracuse • Washington, D.C. • other principal cities

RELIANCE A-C D-C MOTORS

• There is nothing that can take the place of experience. This is particularly true in the steel casting business. For here, so much is dependent upon the human element. It takes experience to develop the skill necessary to make good castings. Sivyer has that experience—35 years of it. And from this come the skill of Sivyer men, and their ability to produce fine steel castings—pressure-tight castings that give maximum service. Critical buyers know that the Sivyer diamond ◈ on a steel casting is worth looking for.

ARMY E NAVY

SIVYER STEEL CASTING COMPANY
MILWAUKEE ◈ CHICAGO ◈



OIL COUNTRY BELT

CONVEYOR BELT

CORD TRANSMISSION BELTS

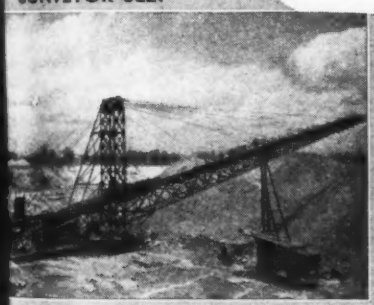
PNEUMATIC HOSE

SPRAY HOSE

EACH of these items is a Mechanical Rubber Product built by Republic for a specific service. Whatever your need for belting, hose, packing, molded, extruded, or hand-built rubber products, consult your Republic Distributor. Through close factory cooperation, he is able to specify the correct construction and the proper type of rubber for every industrial service.

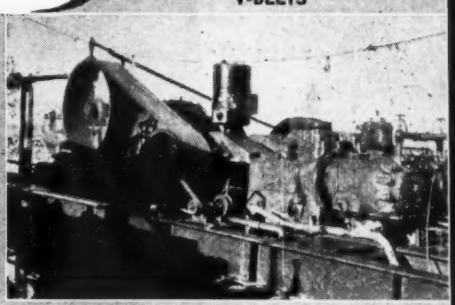
WE ARE PARTICIPANTS IN THE OWNERSHIP AND OPERATION OF NATIONAL SYNTHETIC RUBBER CORPORATION

CONVEYOR BELT



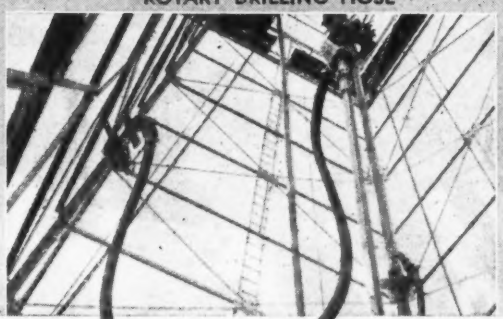
RUBBER-COVERED ROLLS

V-BELTS

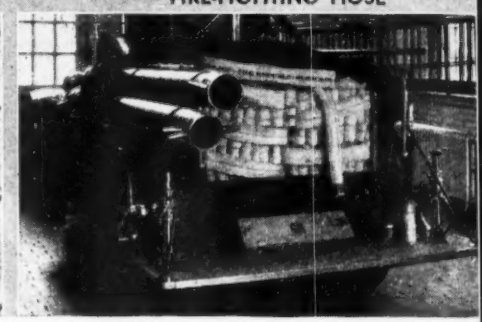


CREAMERY HOSE

ROTARY DRILLING HOSE



FIRE-FIGHTING HOSE



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HOSE • BELTING • MOLDED GOODS PACKING • EXTRUDED PRODUCTS

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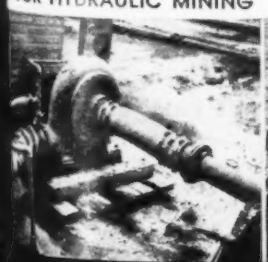
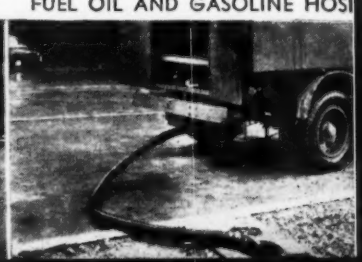


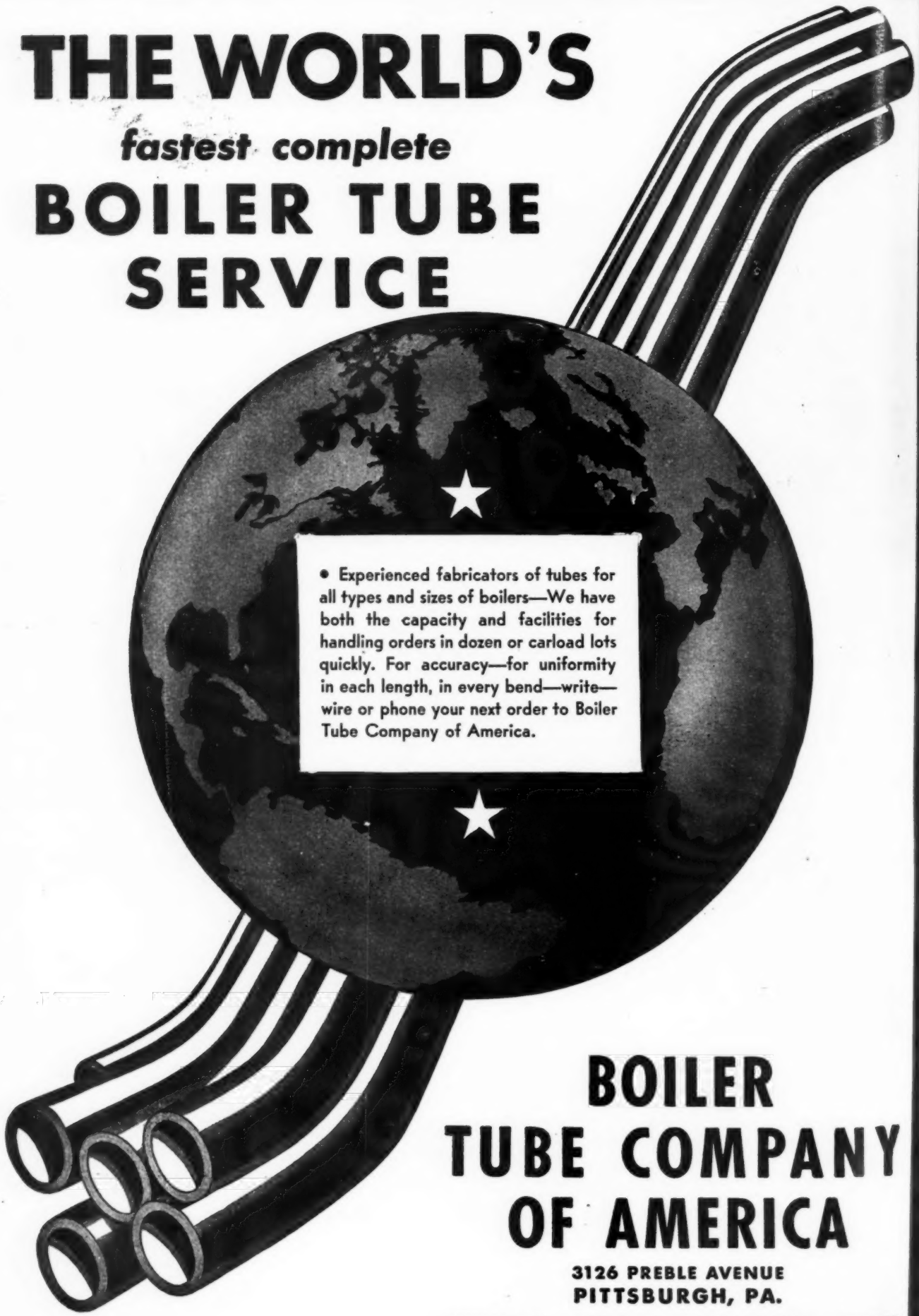
AGRICULTURAL BELT

PACKING AND GASKETS

FUEL OIL AND GASOLINE HOSI



THE WORLD'S
fastest complete
BOILER TUBE SERVICE



• Experienced fabricators of tubes for all types and sizes of boilers—We have both the capacity and facilities for handling orders in dozen or carload lots quickly. For accuracy—for uniformity in each length, in every bend—write—wire or phone your next order to Boiler Tube Company of America.

BOILER TUBE COMPANY OF AMERICA

3126 PREBLE AVENUE
PITTSBURGH, PA.

PITTSBURGH • NEW YORK • PHILADELPHIA • CHICAGO
FRED S. RENAULD & COMPANY, Los Angeles

When bigger stub ends are built"...

• *As you know, Lapped-joint Stub Ends are standardized only in pipe sizes through 24 inches. In this range thousands are used, but it's only on rare occasions that a real whopper like this one is needed. It's a seamless carbon-moly forging nearly seven feet in outside diameter and about two feet long with 1½ inch wall thickness.*

Obviously, we aren't soliciting orders for 84 inch O.D. Lapped-joint Stub Ends. However, when "specials" of this kind are needed, it's a good bet that the job will be turned over to Taylor Forge.

Yes, for many years industry has considered Taylor Forge headquarters for those forging requirements that call for *unusual* knowledge of the behavior of hot metal under pressure and impact.

And isn't it true that this *unusual* "know-how" and facilities also make Taylor Forge headquarters for *unusual value* in your standard requirements for welding fittings?

You can be sure that it does, and if you want further confirmation you can find it in the features of WeldELLS listed opposite.

You will find features that are not combined in any other welding fittings . . . extra reinforcement where stresses are greatest . . . ample tangents . . . extremely accurate dimensions . . . permanent identifications . . . precision quarter marked ends. In short, you will find that

WeldELLS alone combine these features:

- **Seamless** — greater strength and uniformity.
- **Tangents**—keep weld away from zone of highest stress—simplify lining up.
- **Precision quarter-marked ends**—simplify layout and help insure accuracy.
- **Selective reinforcement** — provides uniform strength.
- **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
- **Wall thickness never less than specification minimum**—assures full strength and long life.
- **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.
- **The most complete line of Welding Fittings and Forged Steel Flanges in the World** — insures complete service and undivided responsibility.

WeldELLS have everything

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago. P. O. Box 485
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FLORI FOLLOWS YOUR SPECIFICATIONS

When **YOU** lay out a fabrication job, you can expect us to follow specifications to a tee.

FLORI specializes in accuracy. We are equipped to watch closest tolerances. This "know-how" makes tough, intricate fabrication jobs a natural for us. Your savings in assembly and fitting time alone will pay for a large portion of the job.

A Flori engineer will be glad to drop around any time you say.

If It's Fabrication — Contact Flori

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THE FLORI PIPE COMPANY • ST. LOUIS 15 • CHICAGO 47

"ENEMY ROUTED"..

says...

BOILER ROOM COMMUNIQUE!

Fuel-Saving Starts With CONTROL

VICTORY news is heartening these days — and none is more vital than reports from steam-power plants where Hays Automatic Combustion Control is giving fuel waste and high steam cost a thorough beating.

Many a power plant has been promoted, under the pressure of war industry's effort, to an efficient economical, *safe* plant — through the installation of Hays equipment.

Hay's Combustion Control—"the All-Electric Way" — regulates every combustion factor, to maintain even steam pressure under fluctuating demand. It measures each variable; records its measurements on a central panel; corrects each variation instantly; in short, provides exact, *balanced control —automatically.*

The Hays Combustion Control Catalog is full of helpful steam-power data. Write for a copy today.

HAYS

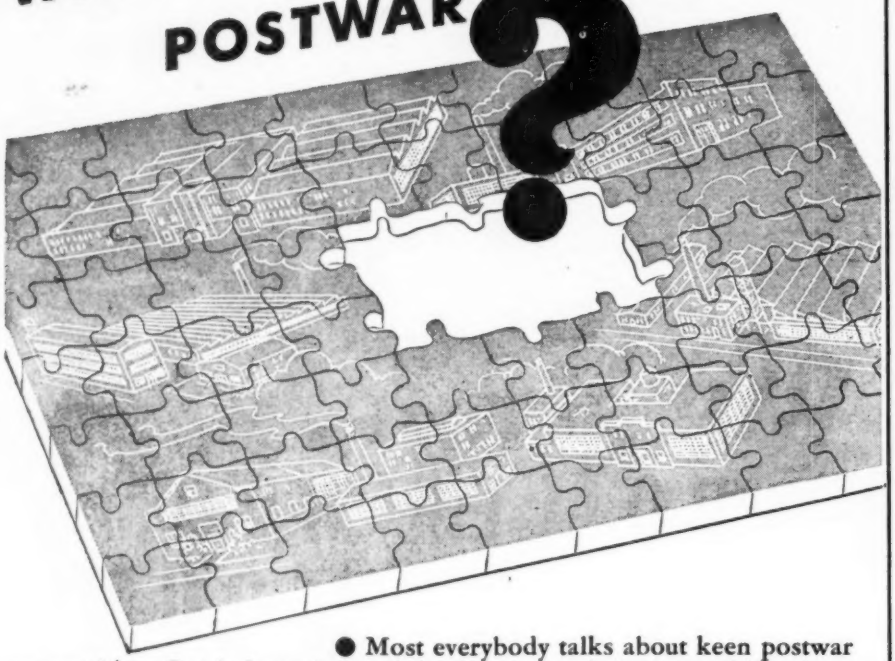
THE MODERN SYSTEM *It's Electrical*

Automatic COMBUSTION CONTROL

THE HAYS CORPORATION • MICHIGAN CITY, IND.

Your plant . . .

WHERE WILL IT FIT IN THE COMPETITIVE POSTWAR PICTURE?



● Most everybody talks about keen postwar competition. But industry's foresighted men are doing something about it. You are, or soon will be surveying your plant and its equipment—planning replacements and modernization—getting ready for quick reconversion after the war.

Adequate plant heating should be up in front in your plans. The war has proved its advantages for increasing plant output and worker productivity as well as improving worker health and morale.

Right now is the time to start a systematic program of modernization—by building in new automatic heating efficiency to meet competitive postwar production *with Modine Unit Heaters.*

Replace obsolete, worn out, inefficient pipe coil or cast iron radiation now with Modines. Or, if you have worn out unit heaters, replace them. If you have been unable to get enough unit heaters for efficient heating heretofore, get the additional unit heaters you need.

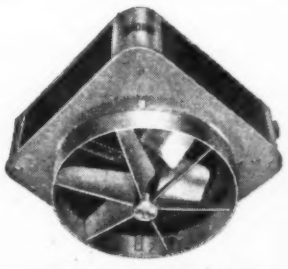
But do it now. You'll save fuel, reduce maintenance, and get adequate heating this winter. You'll avoid disappointing delays tomorrow *and* you'll have a head start on your plans to improve your postwar position.

Modine representatives will help you get this start—show you how to save money by using replacements needed now as part of later installations. *Get descriptive catalogs 144 and 144-A.*

Modine Unit Heaters are available on a priority of AA-5 or better . . . or, on a repair order such as "MRO."

NEW HORIZONTAL DELIVERY MODEL with

- **All-Copper Condenser**
- **Built-in Safety Fan Guard**
- **Bonderite Rust Protection**
- **Sound-Silenced Casing**
- **Patented Direct-from-branch-supply-pipe Suspension**
- **Patented Expansion Bend**



VERTICAL DELIVERY MODEL

modine

UNIT HEATERS

ARMY E NAVY

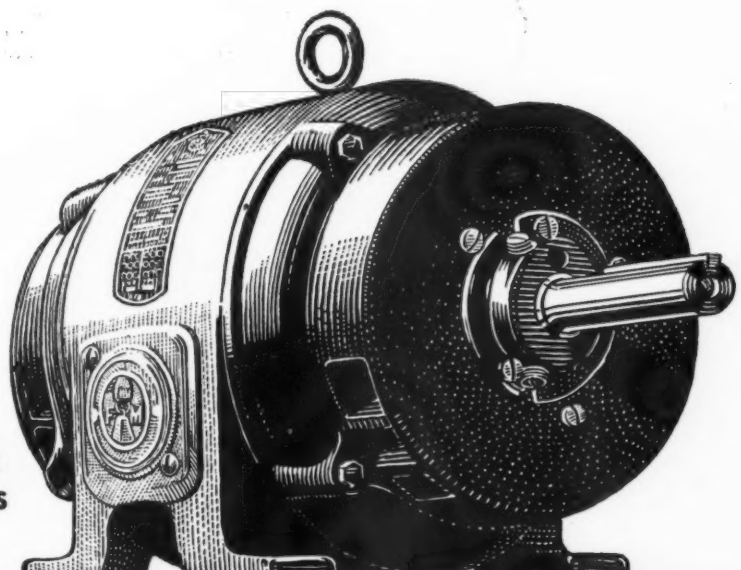
Look in your phone book for Modine representative's name—"Where to Buy It" section.

MODINE MANUFACTURING COMPANY, 1730 RACINE STREET, RACINE, WISCONSIN

A name worth remembering!

FAIRBANKS-MORSE

After the war, the name Fairbanks-Morse will continue to mark performance-proved products only, as it has for 114 years. No race to get civilian products onto the market early will tempt us to break this pledge.



Features of the New Fairbanks-Morse General-Purpose Motor

- *It is a 40° C. motor.*
- *It is a protected motor.*
- *It has an optional conduit box assembly.*
- *It has cross-flow ventilation.*
- *It has ball bearings, sealed in and protected.*
- *It has the exclusive Fairbanks-Morse* Copperspun Rotor.

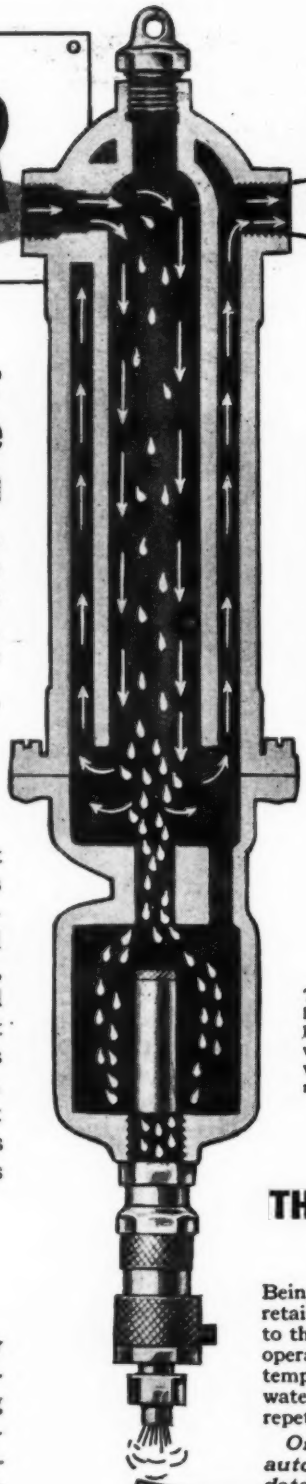
BUY MORE WAR BONDS

DIESEL LOCOMOTIVES • DIESEL ENGINES • GENERATORS • MOTORS • SCALES • PUMPS • STOKERS • RAILROAD AND FARM EQUIPMENT

FAIRBANKS, MORSE & CO., CHICAGO 5, ILLINOIS

FREE AIR

Dehydrated and Cleaned!



Moisture and oil in your compressed air can raise the devil with war production

Precipitated moisture gets into tools, washes away lubricating oils and causes excessive wear. It produces "water hammer" in pipe lines and can easily result in loss of power, rust and ice formation. Water and oil in the air spoils work, such as spray painting . . .

They're a costly pair that take the "free" out of free air.

How to insure clean, dry air

The only sure way to insure a constant supply of clean dry air at every outlet is to provide separators that work automatically. Traps will not capture entrained moisture and oil while the air is in motion, and unless drained automatically of all moisture precipitated while the air is quiet will actually put moisture into the air as soon as this air reaches sufficient velocity. Manually operated traps, therefore, cannot *eliminate* the moisture and oil which is sure to be present, and the blow-off results in considerable lost air.

THE SWENDEMAN VENTING PRINCIPLE

The Swendeman Separator is scientifically designed to eliminate oil and moisture without retarding the flow of air or decreasing the pressure. It consists of a series of expansion chambers connected with an "Eliminator" which is vented to atmosphere. The Eliminator receives all moisture and foreign matter collected by the Separator, and expels it immediately, allowing the air no opportunity to pick it up again.

TYPE "A." Used in installations where pressure regulation is not necessary and where air may be shut off while valve and screen are removed for cleaning.

TYPE "C." Can be used on all work same as Type "A" but it has the advantage of the valve equipment between separator body and eliminator. This makes it possible to clean valve and not interfere with air supply beyond separator.

THE SWENDEMAN SEPARATOR IS NOT A TRAP

Being open to atmosphere at all times, the Separator retains no oil or water, nor permits these fluids to return to the line. Drawing off oil and water by means of hand operated valves or intermittent blow-offs affords only temporary relief, for as soon as the valve is closed, oil and water start accumulating again, necessitating frequent repetition of the operation.

Only the Swendeman Separator works on proved, automatic, result-getting principles. Write for detailed literature.

SWENDEMAN
Automatic Separator
A DEXTER PRODUCT

The **LEAVITT**
MACHINE COMPANY
ORANGE, MASSACHUSETTS

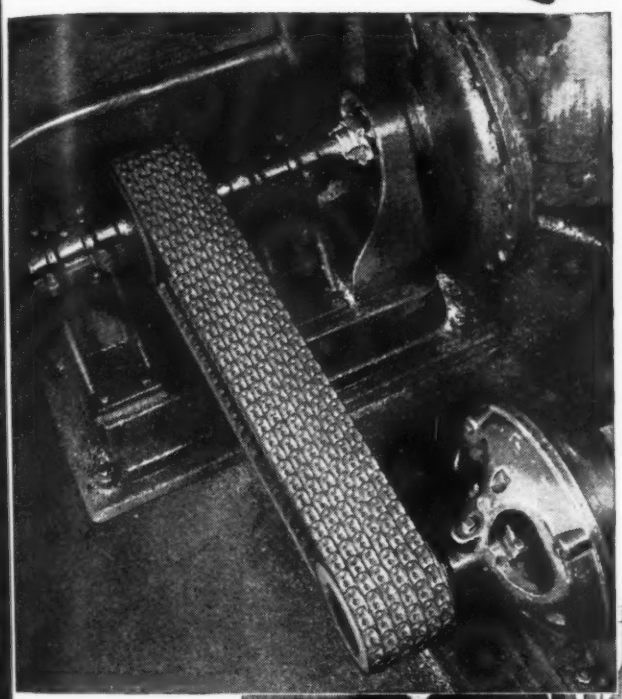
Pumps, Generators and Compressors Stay on the Job with Dependable VEELOS

THE ADJUSTABLE V-BELT

Veelos—the adjustable V-belt—promotes continuous operation of large compressors and generators as well as small . . . of pumps in all capacities. It's the adjustable link construction of Veelos that helps these important units to stay on the job . . . cuts installation and repair downtime to practically zero. Consider these Veelos advantages:

1. Veelos is Easy to Install: Any desired length of belt can be uncoupled from an economical stock roll of Veelos and installed on any drive in a few minutes.

2. Veelos is Easy to Adjust: Belts can be adjusted to maintain uniform tension simply by removing links.



12-strand Veelos V-belt driving 250 HP compressor.

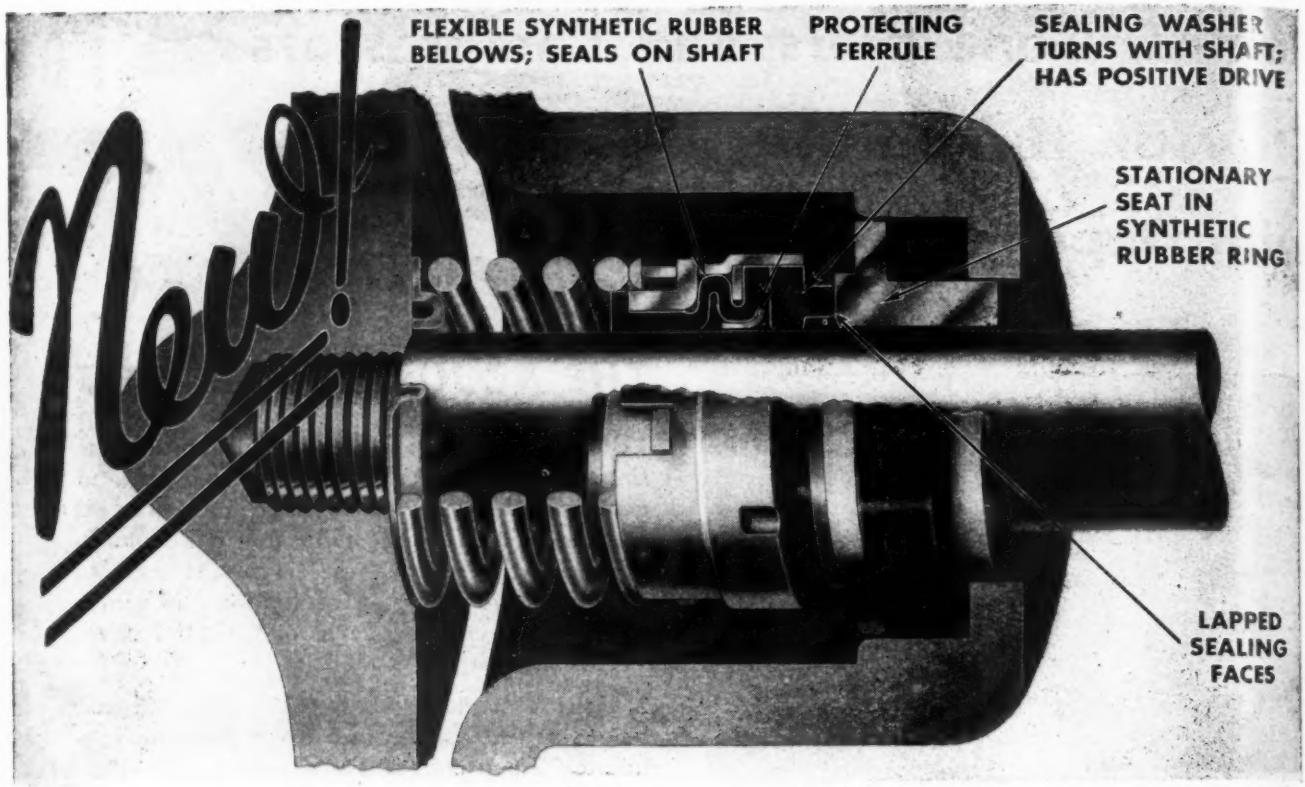
6-strand Veelos V-belt operating 20 HP pump.

Keep your pumps, generators and compressors running without costly shutdowns for belt servicing. Learn the facts about Veelos from *free 8-page illustrated manual* giving applications, construction detail, installation directions and engineering data.

MANHEIM MANUFACTURING & BELTING CO.
200 MANBEL ST., MANHEIM, PENNSYLVANIA

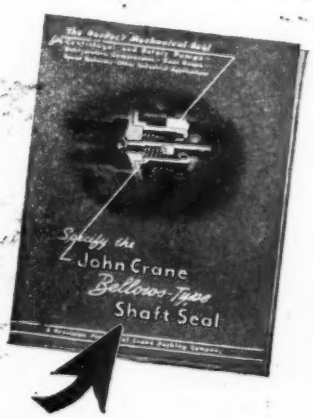
VEELOS
THE LINK
V-BELT
ADJUSTABLE TO ANY LENGTH
ADAPTABLE TO ANY DRIVE

LINK CONSTRUCTION UPS PRODUCTION


New!
FLEXIBLE SYNTHETIC RUBBER BELLOWS; SEALS ON SHAFT
PROTECTING FERRULE
SEALING WASHER TURNS WITH SHAFT; HAS POSITIVE DRIVE
STATIONARY SEAT IN SYNTHETIC RUBBER RING
LAPPED SEALING FACES

JOHN CRANE *Bellows-Type* SHAFT SEAL

- **The Perfect Mechanical Seal** for Centrifugal Pumps—Refrigeration Compressors—Speed Reducers—Rotary Pumps—Agitator Shafts—Many Other Rotary Sealing Applications.
- **Eliminates** Leakage, Gland Adjustment and Shaft Wear—Reduces Friction—Saves Power —Seals Perfectly at High Speeds and High Pressures.
- **Exclusive Features**—
  1. **Flexible Synthetic Rubber Bellows Head** slides freely—provides automatic compensation for washer wear, shaft vibration and end play through wide range.
  2. **Protecting Ferrule** prevents Bellows Head from touching shaft. **Assures free sliding** at all times.
  3. Sealing washer has **positive drive** through metal parts.
  4. **A Complete Unit, ready for use.** Sealing faces factory-lapped.
- This Precision-Built Shaft Seal is already thoroughly proven on many exacting services.



Design and Development Engineers — Send for Illustrated Bulletin

CRANE PACKING COMPANY

1811 CUYLER AVENUE • CHICAGO 13, ILLINOIS

16 YEARS SERVICE—87.5% EFFICIENCY

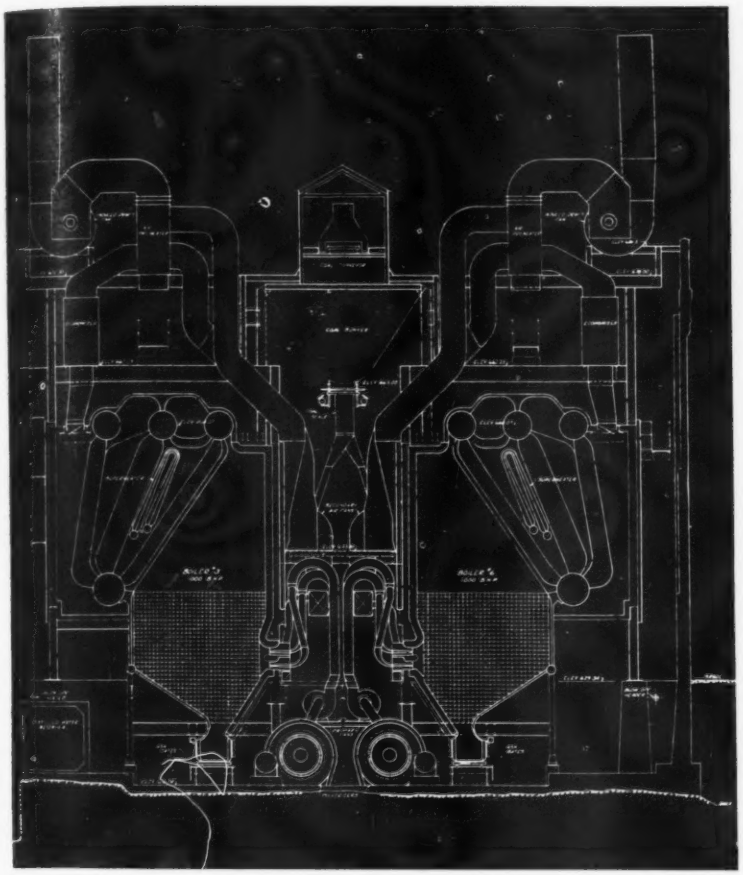
and a

REPEAT ORDER

for

KENNEDY

AIR SWEPT TUBE MILLS



These KENNEDY AIR SWEPT TUBE MILLS produce a continuous fineness of 93.0% through 200 mesh, and 70% through 325 mesh on Strip Mine Illinois Coal. These mills have maintained 85% through 200 mesh with coal having 12% moisture.

Power consumption is 14.1 KW per ton of coal pulverized. Maintenance on KENNEDY AIR SWEPT TUBE MILLS has averaged $0.0122 per ton over a period of 16 years continuous service. Average monthly boiler efficiency 87.5%.

This installation—made sixteen years ago in a large mid-western central power station—includes 3-1000 H.P. boilers, equipped with superheaters, economizers and air-preheaters. Each boiler is fired with 2-KENNEDY AIR SWEPT TUBE MILLS, 5 ft. diameter by 9 ft. long.

TWO MORE KENNEDY MILLS

Based on this performance, (2) 8' x 13' KENNEDY AIR SWEPT TUBE MILLS were selected for coal preparation in this plant with the addition of a boiler of 450,000 lbs. per hour, 1200 lbs. pressure and 900° temperature. This installation has now been in operation for approximately 18 months.

Complete Engineering Service

KENNEDY-VAN SAUN offers a complete steam power plant service under one responsibility, which includes supplying complete steam generating units, pulverizing equipment, burners, fans, coal elevators, bunkers, coal weighing scales, ash conveyors and necessary equipment. Ask for complete details.

Write for Bulletin 12

Let our engineers help you with your special problems of burning lower grade coal to meet your production requirements.

Kennedy-Van Saun

MANUFACTURING AND ENGINEERING CORPORATION

2 PARK AVE., NEW YORK 16, N. Y.

Factories: Danville, Pa., Canada, England, Australia

THIS BOOK TELLS YOU HOW TO DO IT—MAIL COUPON

Kennedy-Van Saun Mfg. & Engr. Corp., 2 Park Ave., New York 16, N. Y.

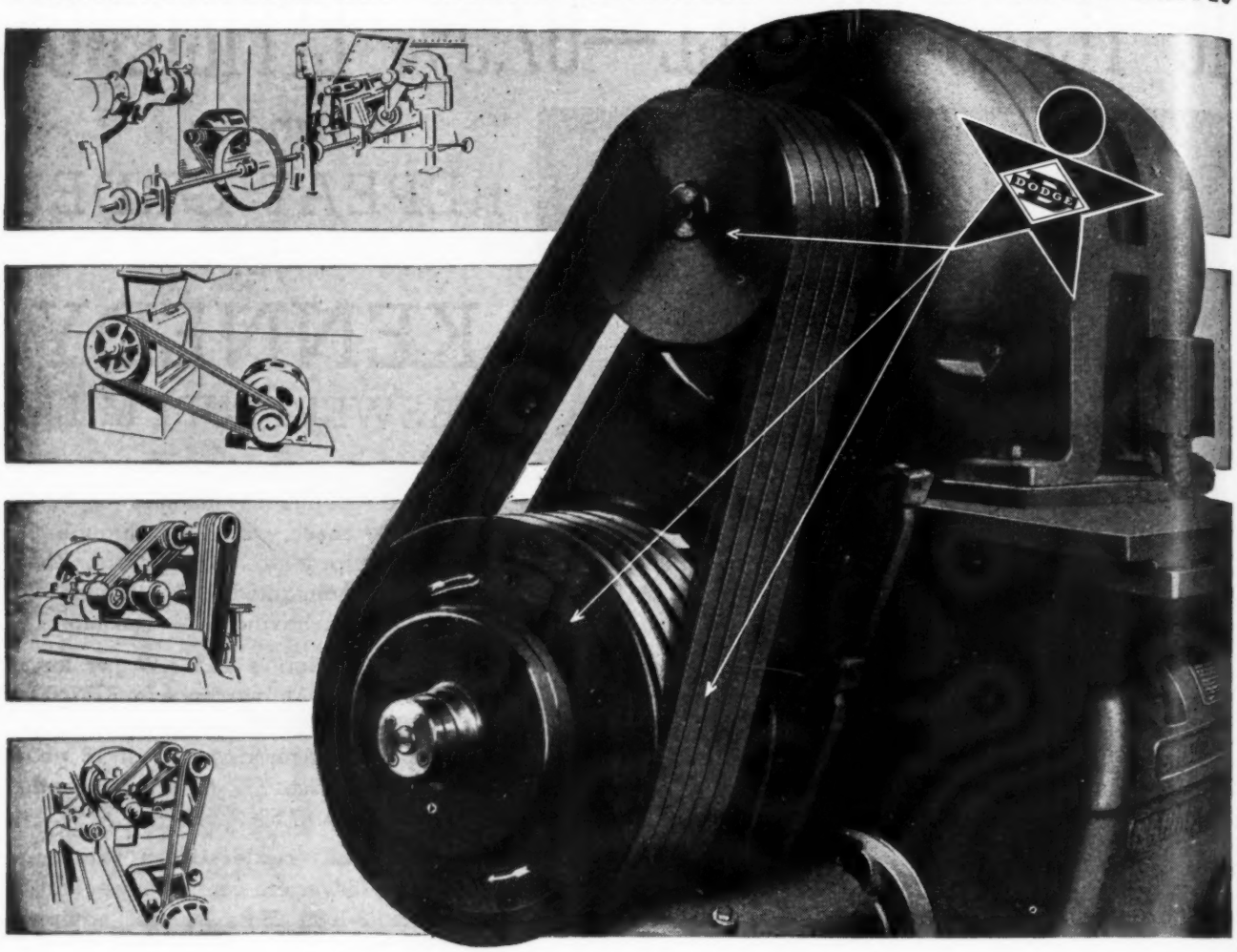
Kindly send me Bulletin No. 12 explaining how lower grade coals can be burned efficiently.

Name.....Position.....

Company.....

Address.....P-10-44

TRANSMISSIONEERED MEANS ADVANCED DESIGN IN POWER DRIVES



Put the Dodge Transmissioneer on your Staff

When it's a matter of putting power to work — all of it—it's a job for the Dodge Transmissioneer. These specialists are graduates of a factory course in "transmissioneering" who know how to solve power drive problems effectively and economically.

Transmissioneered means advanced design in power drive equipment. Dodge Transmissioneers work with a complete line of standardized and precision-built bearings, sheaves, pulleys, clutches and other drive components which insures "The Right Drive for Every Job".

Whether your problem is one of stepping up war production or planning for reconversion, the Dodge Transmissioneer — your local Dodge distributor — can give you valuable counsel and, in many cases, supply your immediate needs from his local stock. Put him on your operating staff — his service is as close as your telephone.

DODGE MANUFACTURING CORPORATION
Mishawaka, Indiana, U. S. A.

BUY MORE WAR BONDS

DODGE

The Sign of the Dodge Transmissioneer

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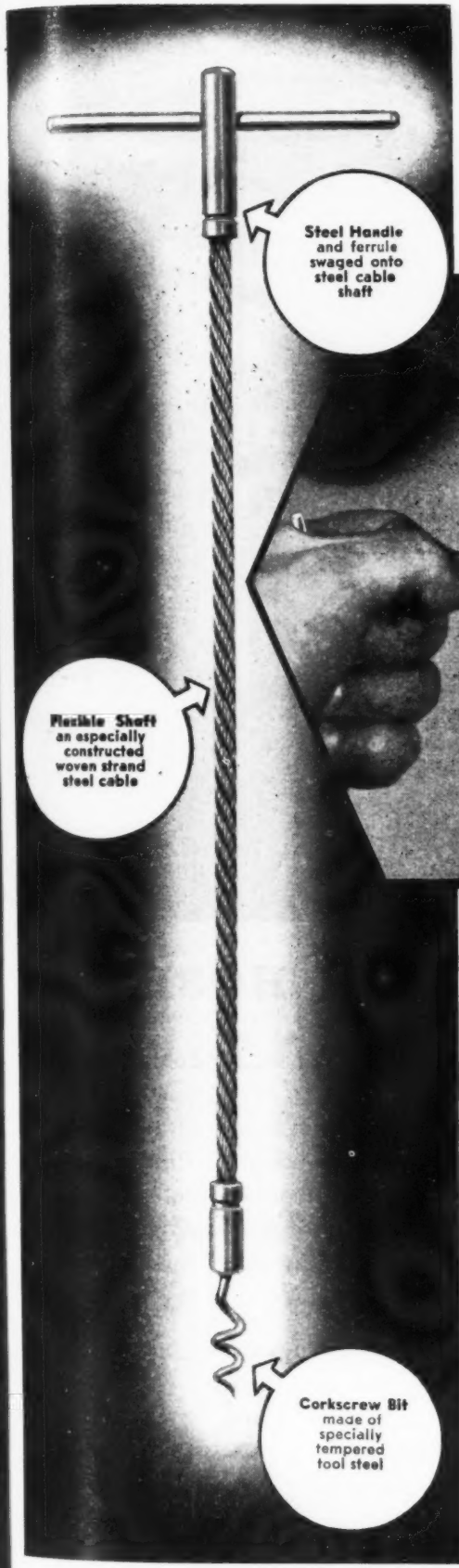
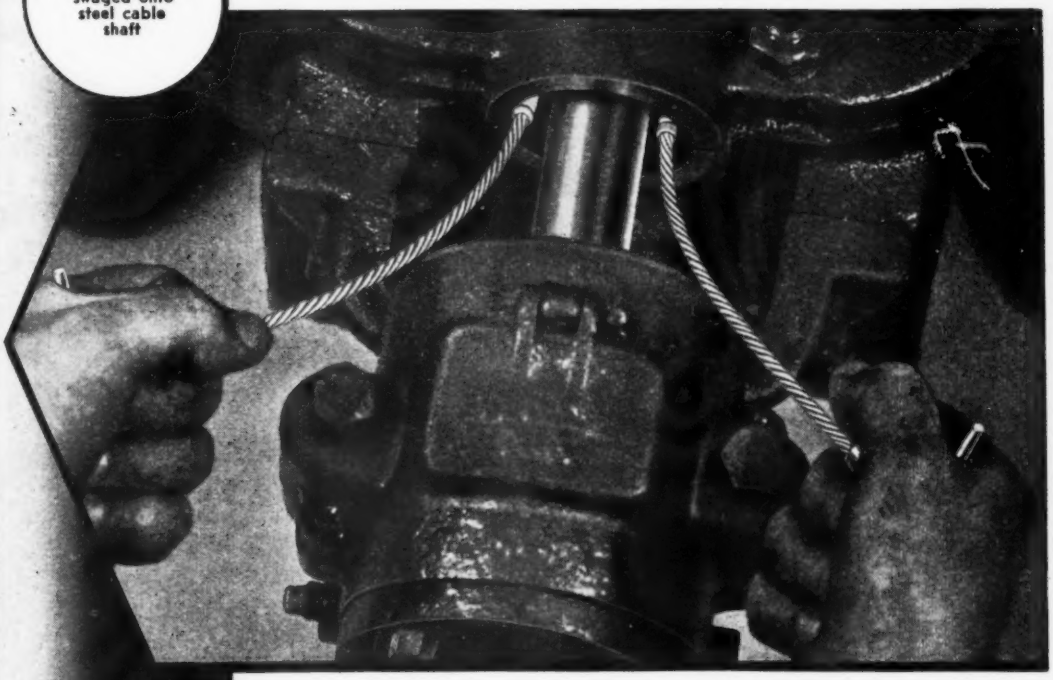
The Right Drive for every Job

Remove Packings THIS BETTER WAY


Steel Handle and ferrule swaged onto steel cable shaft
Flexible Shaft an especially constructed woven strand steel cable
Corkscrew Bit made of specially tempered tool steel



DURA HOOKS.. flexible All-Steel Packing Pullers

Here is a time and labor saving device for removing old packing from stuffing boxes. DURA HOOK (Patented) is a tough, flexible hand tool that can be used in those "hard-to-get-at" places. *For best results use two hooks as shown in illustration.* Order your requirements today. . . .

DURA HOOK SIZES AND PRICES

Hook No.	Length	Screw Diam.	Packing Space Size Recommended for	Price 1 Hook	Price 2 Hooks
No. 1	7½ inches	7/32 inch	¼ to 5/16 inch incl.	$1.15	$2.30
No. 2	11 inches	5/16 inch	3/8 inch	1.40	2.80
No. 3	15 inches	3/8 inch	7/16 to ½ inch incl.	1.60	3.20
No. 4	19 inches	½ inch	9/16 to 5/8 inch incl.	2.80	5.60
No. 5	22 inches	5/8 inch	11/16 to 1 inch incl.	3.20	6.40
No. 6	30 inches	1 inch	Over 1 inch	4.80	9.60

HANDY SETS

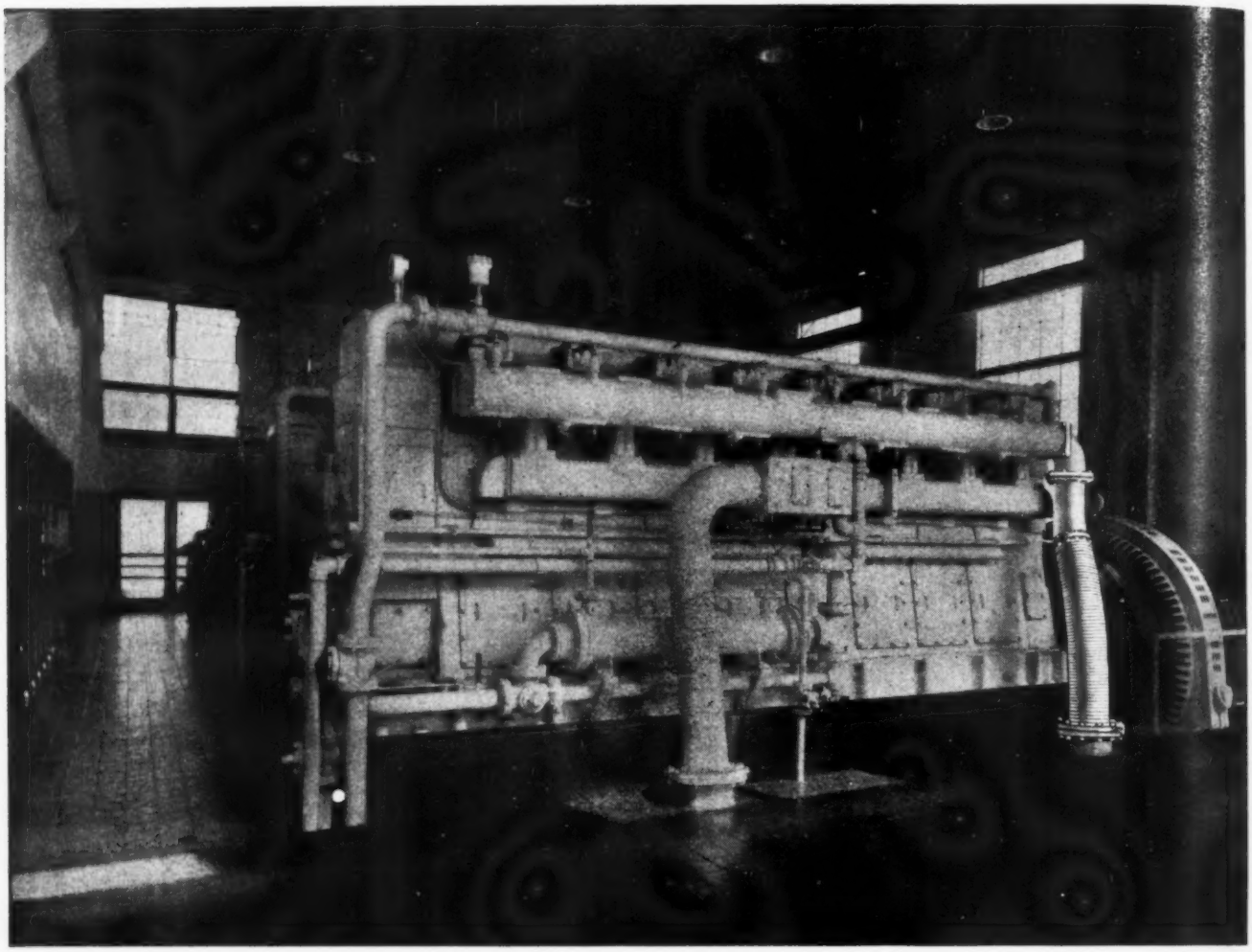
Set Number	Description	Price 1 Set	Price 2 Sets
Set A	Consists of first three hooks	$4.00	$8.00
Set B	Consists of first four hooks	6.80	13.60
Set C	Consists of first five hooks	10.00	20.00
Set D	Consists of all six hooks	14.80	29.60

ASK YOUR JOBBER . . . OR ORDER DIRECT FROM FACTORY TODAY

The PERFECT SEAL

DURAMETALLIC CORPORATION

KALAMAZOO MICHIGAN



PENFLEX FLEXIBLE METALLIC HOSE with

Armored Flexibility for Safety and Service

Important factors in generating power are Service and Safety. That's why PENFLEX is found on many generator sets in power plants throughout the country. PENFLEX with 4-wall interlocking joint construction gives long life and trouble-free service on intake and exhaust lines, oil, water and other connections. It resists thermal and mechanical strains and fatigue; absorbs vibration and provides safety plus economical service.

For fuel oil feed, starting air and manifold drain lines, the corrugated, jointless construction of PENFLEXWELD provides flexibility, expands or contracts easily with changes of temperature, pulsation of pressure, and remains unnoticed because of its almost completely trouble-free service.

Full data on PENFLEX All-Metal Pipes for Diesels in Bulletin 71. PENFLEXWELD is described in Bulletin 90. Write for these Bulletins.

PENNSYLVANIA FLEXIBLE METALLIC TUBING CO.

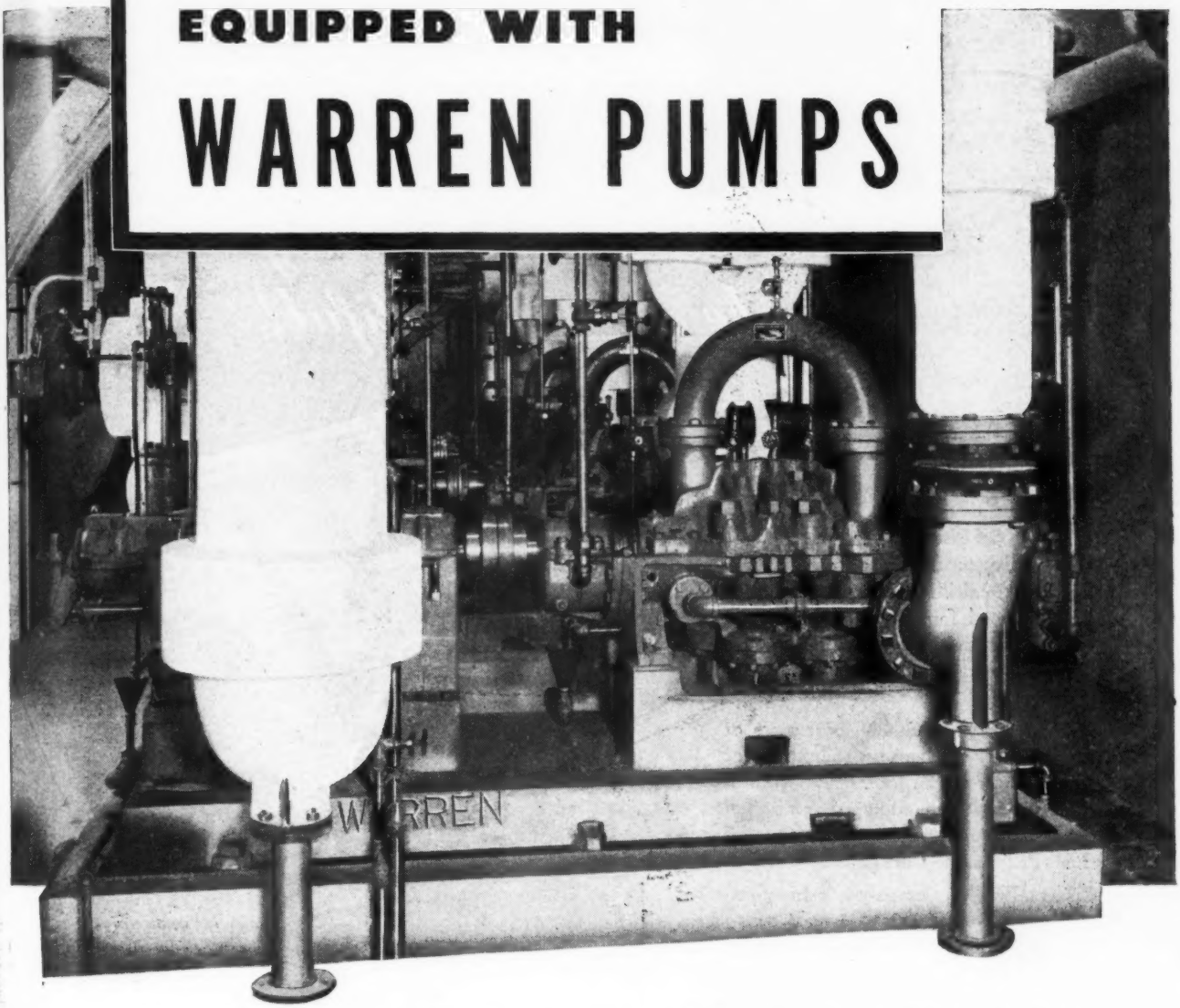
7238 Powers Lane, Philadelphia 42, Pa.

ESTABLISHED 1902

IMPORTANT

MAINE POWER PLANT EQUIPPED WITH

WARREN PUMPS



This modern power plant at Wiscasset, Maine, together with a similar plant at Bucksport, Maine, are two extremely important adjuncts of the Central Maine Power Company's system.

High speed, high pressure, Warren Centrifugal Boiler Feed Pumps assist these plants in helping to carry the load when water is low for development of hydro-electric power. The Warren Pump in the foreground is turbine driven; the next two in view are motor driven.

Ashore or afloat, Warren Pumps for Victory!

ARMY E NAVY

WARREN STEAM PUMP CO. INC., WARREN, MASSACHUSETTS

P E N I C I L L I N

That the Drug of Mercy may be More Plentiful!

SCIENCE discovered it. Research developed it. Exigencies of war forced volume production. Penicillin was so urgently needed by the armed forces our government requested increased facilities for its manufacture as rapidly as was humanly possible.

And within a remarkably short space of time, the large modern penicillin plant of Chas. Pfizer & Co. Inc., manufacturing chemists, was built, equipped and in full operation producing large quantities of this vitally-needed drug.

Cleaver-Brooks' part in the achievement was the installation of two Cleaver-Brooks steam generators of the type successfully used in hundreds of other modern, progressive manufacturing plants. The Company wrote us:

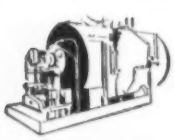
"The very short time in which we were able to complete the plant was due, in no small measure, to the prompt deliveries made by suppliers such as yourselves, which aided us in meeting the needs of our armed forces. We want you to know that we recognize and appreciate the important part you played in helping us to make this excellent record."

CLEAVER-BROOKS COMPANY
Dept. 5109. MILWAUKEE 9, WISCONSIN

* The Cleaver-Brooks installation in Chas. Pfizer and Company's modern penicillin plant in New York consists of two 300 H. P., 200 lb. working pressure, CLEAVER-BROOKS Steam Generators. These units are compact, factory-assembled, oil-fired, and operate at a high thermal efficiency. Automatic operating features and complete combustion assure cleanliness and lowest operating and maintenance cost.

Cleaver-Brooks
STEAM GENERATORS

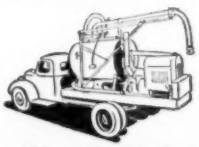
CLEAVER-BROOKS PRODUCTS INCLUDE:



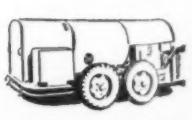
Steam Generators

Food Processing Equipment

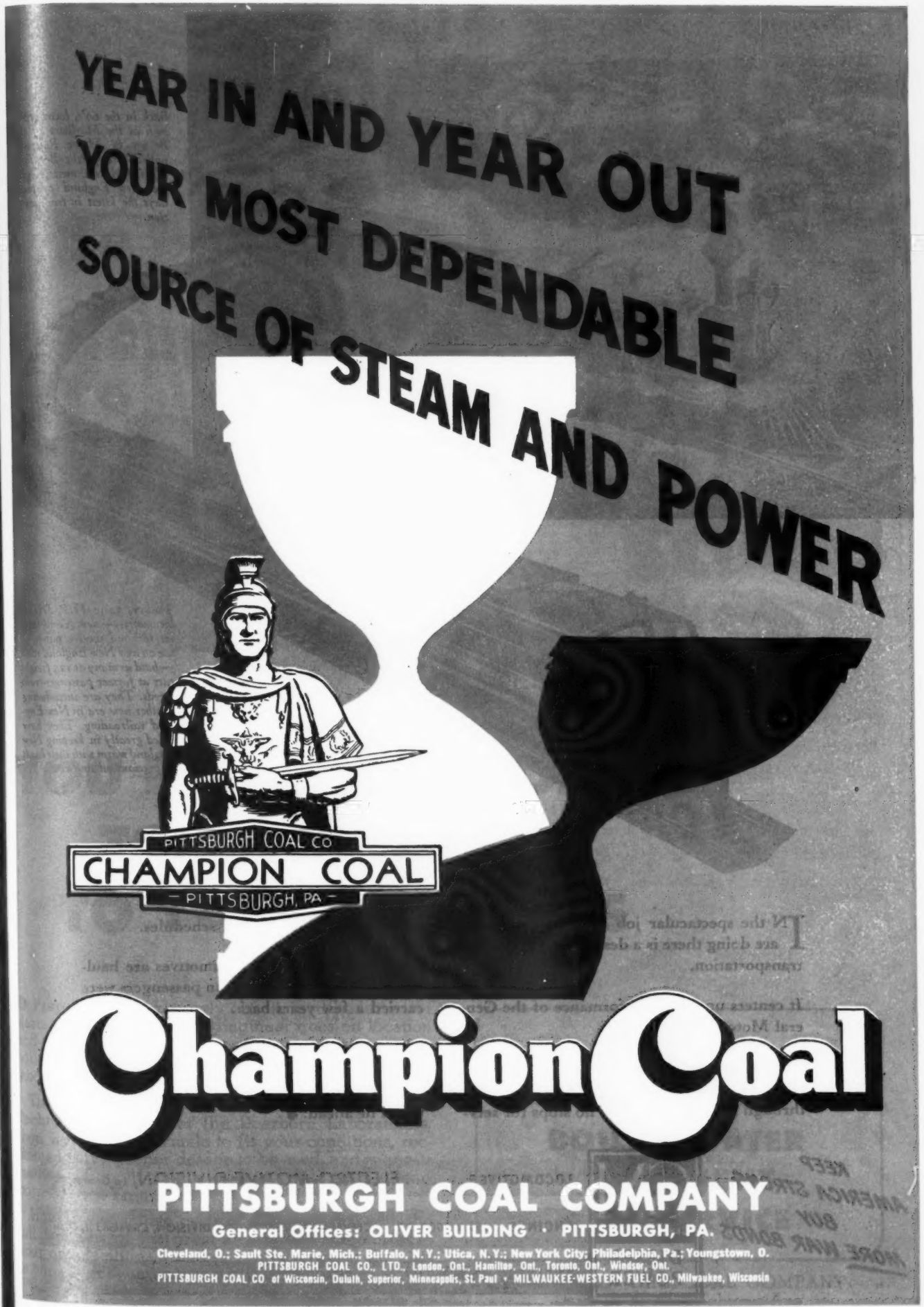
Tank Car Heaters

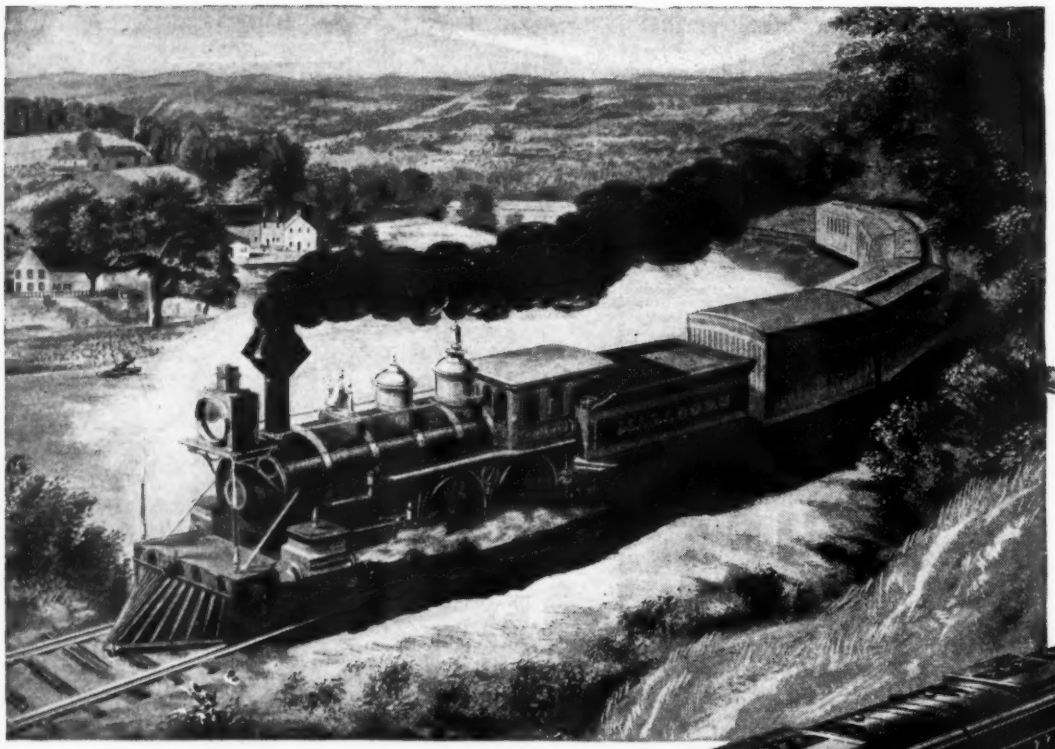


Bituminous Boosters



Special Military Equipment


YEAR IN AND YEAR OUT
YOUR MOST DEPENDABLE
SOURCE OF STEAM AND POWER
PITTSBURGH COAL CO
CHAMPION COAL
PITTSBURGH, PA
Champion Coal
PITTSBURGH COAL COMPANY
General Offices: OLIVER BUILDING · PITTSBURGH, PA.
Cleveland, O.; Sault Ste. Marie, Mich.; Buffalo, N.Y.; Utica, N.Y.; New York City; Philadelphia, Pa.; Youngstown, O.
PITTSBURGH COAL CO., LTD., London, Ont., Hamilton, Ont., Toronto, Ont., Windsor, Ont.
PITTSBURGH COAL CO. of Wisconsin, Duluth, Superior, Minneapolis, St. Paul · MILWAUKEE-WESTERN FUEL CO., Milwaukee, Wisconsin



Back in the 60's, locomotives such as the Marlboro of the Boston & Maine Railroad puffed through the Berkshire Hills of Massachusetts, to give the New England of those days the latest in transportation.

Today, 5400-H.P. Diesel locomotives—newest and largest railroad motive power in use on any New England road—haul as many as 125 freight cars at former passenger-train speeds. They are introducing another new era in New England railroading. They have aided greatly in keeping New England warm with their loads of precious oil and coal.

HERALD OF TRANSPORTATION'S FUTURE

IN the spectacular job America's railroads are doing there is a design for finer future transportation.

It centers upon the performance of the General Motors locomotive.

Part of this performance lies in this locomotive's work. It is quick to get away—carries through its job with few or no stops for service—gets there on clipped schedules.

In run after run these locomotives are hauling heavy freight faster than passengers were carried a few years back.

These achievements are elements in railroad progress. They are forerunners of a great new era of transportation efficiency in the days which lie ahead. ●

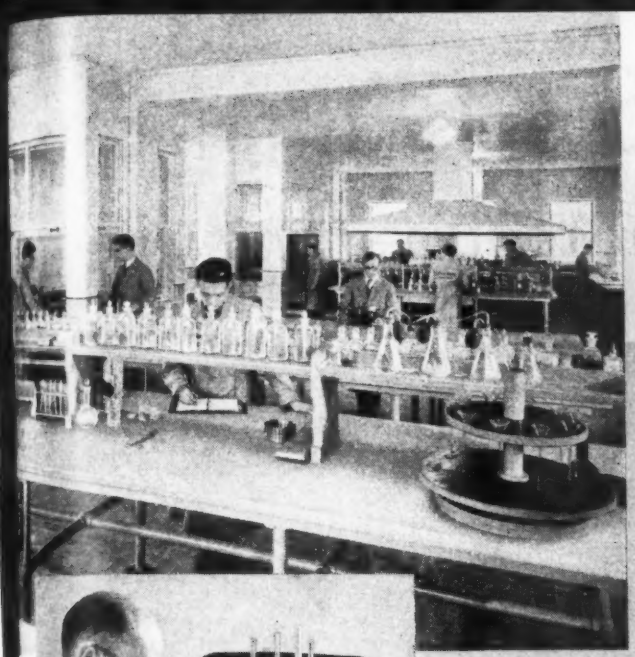
KEEP AMERICA STRONG BUY MORE WAR BONDS

GM
GENERAL MOTORS
DIESEL POWER

LOCOMOTIVES . . . . . **ELECTRO-MOTIVE DIVISION,** La Grange, Ill.

ENGINES . . 150 to 2000 H.P. . . . CLEVELAND DIESEL ENGINE DIVISION, Cleveland 11, Ohio

ENGINES . . . 15 to 250 H.P. . . . . DETROIT DIESEL ENGINE DIVISION, Detroit 23, Mich.



(Left) The Chief Technical Engineer is the contact between your plant, the Dearborn Service Engineer, and Dearborn Laboratories. He writes the recommendations.

(Right) The Dearborn Engineer is always nearby and subject to your call. He works in your boiler room with your men to get the best results. He is the water expert on the job.

YOU NEED NO PRIORITY TO ADD THIS LAB TO YOUR FACILITIES

● Preparation for properly conditioned boiler water starts when the Dearborn Engineer goes on location and makes survey and water tests right in your own boiler plant. From there, water samples go to our laboratories where they are analyzed.

The coordinator of all these findings, the Chief Technical Engineer at the Dearborn Laboratories, then works out a formula to fit *your* conditions, recommends the proper dosage to be used, and suggests methods of application to be supervised by the Dearborn Service Engineer.

Here is a complete cycle of efficiency that adds the full facilities of the great Dearborn Laboratories to your own facilities, whether you have water chemists in your employ or not.

There is a Dearborn Service Engineer nearby to serve you. Get in touch with him or direct with us.

Dearborn

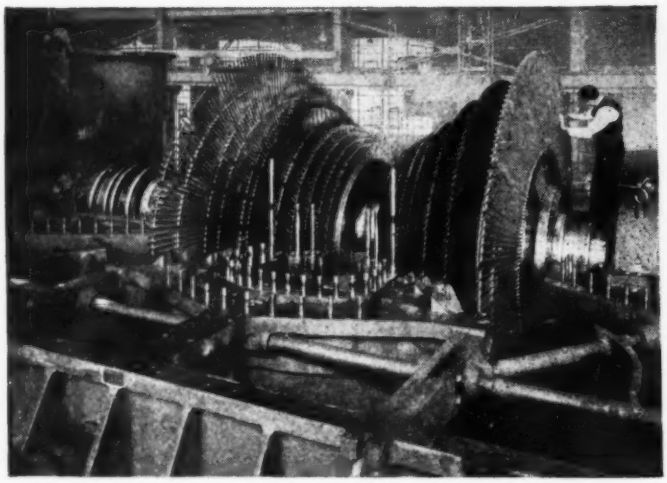
TRADE MARK REGISTERED

BOILER WATER TREATMENT AND SERVICE

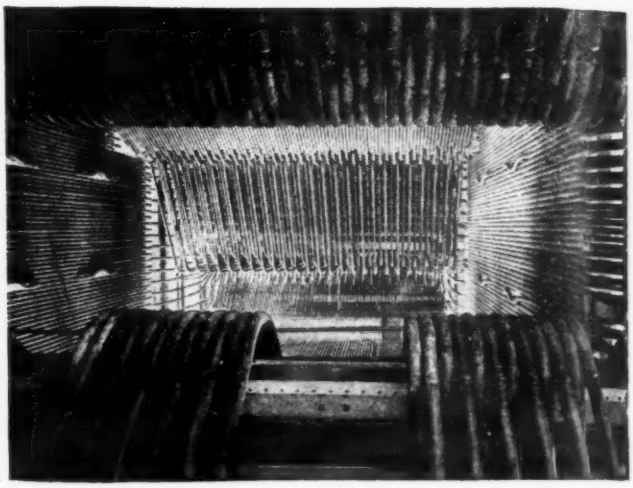
DEARBORN CHEMICAL COMPANY
Dept. D, 310 S. Michigan Ave.
Chicago 4, Illinois

How Chromium Steels and Irons

meet power plant requirements



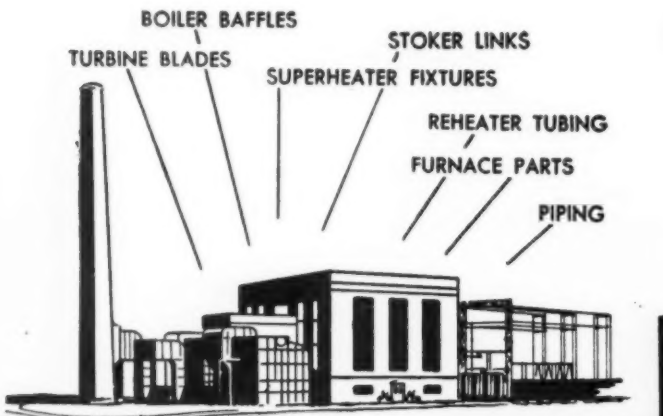
Turbine blades resist corrosion and erosion when made of stainless steel.



In this high-pressure, high-temperature boiler, connection superheater tubes are 4 to 6 per cent chromium.

● Chromium irons and steels for such parts as superheater tubes, steam pipes, turbines, furnace parts, and other power plant equipment help to give efficient, trouble-free performance. Steels containing from 4 to 6 per cent chromium and 0.5 per cent molybdenum, for instance, have good resistance to scaling and creep. The 18-8 chromium-nickel stainless steels have high strength and resistance to corrosion and oxidation. Higher chromium steels have good resistance to oxidation at high temperatures. Chromium cast irons resist wear and growth even when repeatedly heated and cooled. The illustrations show a few applications which may suggest where you can use chromium irons and steels to advantage.

We do not make iron or steel of any kind, but we have for over 38 years produced Electromet ferro-alloys used in making iron and steel. With the knowledge accumulated from this experience, we are in a position to give you impartial assistance in the selection of a chromium iron or steel to suit your particular needs.



"Electromet" is a registered trade-mark of Electro Metallurgical Company

ELECTRO METALLURGICAL COMPANY

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, N. Y.

In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

BUY UNITED STATES WAR BONDS AND STAMPS

Electromet
Trade-Mark
Ferro-Alloys & Metals

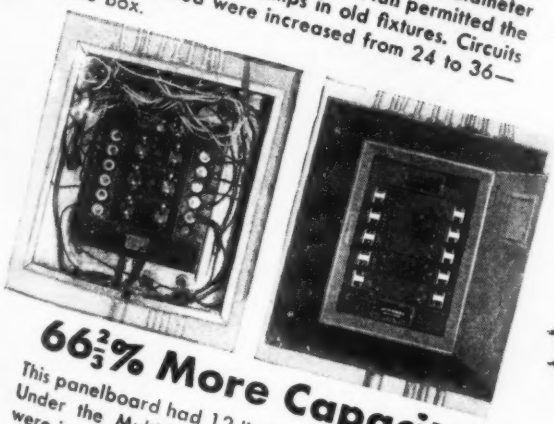
more capacity THROUGH THIS SPEEDY *Square D* CONVERSION PLAN

300% More Capacity!

This panel with 3 fusible circuits was converted to a modern circuit breaker installation with 12 circuits. Notice, too, that provision has been made for an additional 8 circuits whenever they are needed.

50% More Capacity!

300 watt lamps were being used. Panelboards were running hot and voltage drop was heavy. Small diameter wire and the multi-breaker Conversion Plan permitted the use of 500 and 750 watt lamps in old fixtures. Circuits in the panel illustrated were increased from 24 to 36—in the same box.



66⅔% More Capacity!

This panelboard had 12 lighting and power circuits. Under the Multi-breaker Conversion Plan, circuits were increased to 20 without removing the existing box or adding conduit.

Here are three typical examples of conversions which involved a minimum of installation time and labor and brought the following results:

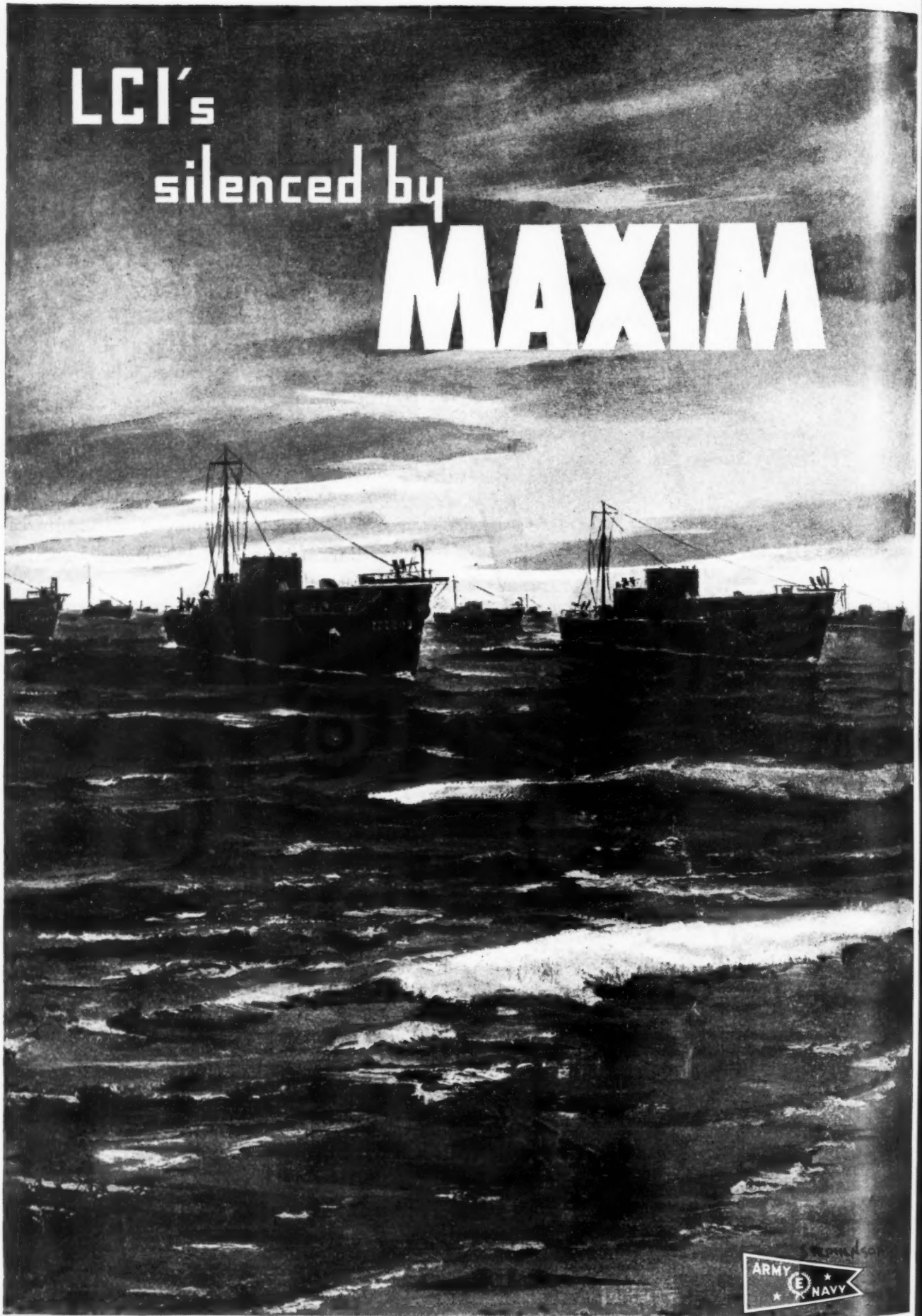
- Increased panelboard capacities and added modern circuit breaker convenience and protection.
- Utilized existing boxes and conduit.
- Conserved power previously lost through over-loads.
- Eliminated the replacement of branch circuit switches and fuse clips due to excessive heating.

CALL IN A SQUARE D FIELD ENGINEER

Increasing the efficiency of your electrical distribution system will help to meet today's manpower shortages and will pay big dividends in the highly competitive and narrow-margin days ahead. A Square D Field Engineer will be glad to work with you on any conversion problem

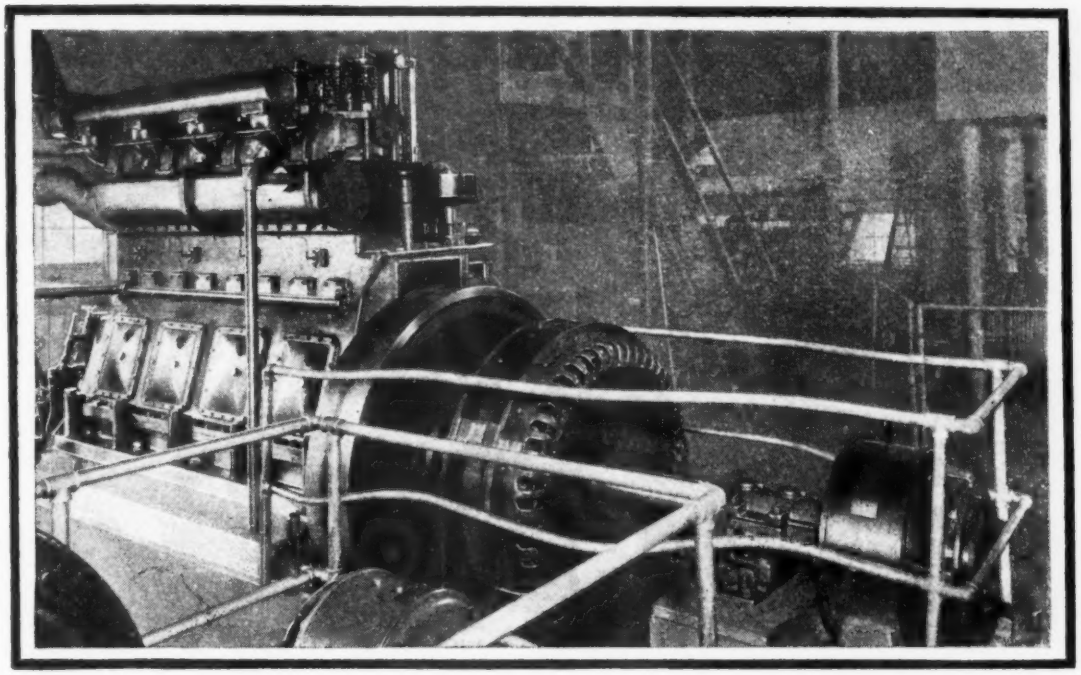
SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES



THE MAXIM SILENCER COMPANY, HARTFORD 5, CONN.....

LET'S LOOK AT THE RECORD...



In 10 Years This Worthington Diesel Delivered 8,511,660 KW. HRS. —Running 96.5% of Elapsed Time On Toughest Oil Field Service

Performance of Worthington Diesels under some of the severest service conditions in Industry . . . is a good indication of how they will perform in your plant.

For instance, this 4-cycle, heavy-duty engine furnished power for motor-driven water pumps repressuring oil wells, and for two or three 25/65 hp. motors usually used on drilling rigs . . . during 10 record years in Bradford, Pennsylvania. Resold, it is still giving satisfactory service today.

For full details, write for Bulletin RP–203, a reprint of an article in a leading Diesel publication.

HANDY GUIDE TO DIESEL COSTS AND APPLICATIONS

Send also for "Diesel Engines", an informative discussion by a Worthington engineer. It describes how to estimate costs of different types of power . . . gives facts on Diesel power progress and applications, on pipe lines, in water works, for refrigeration, air conditioning and general industrial service. Ask for Bulletin WG1–74.

Worthington Pump and Machinery Corporation, Harrison, N. J.

Ten-Year "Box Score" of a Worthington Engine

Total KW. hrs. generated.	8,511,660
Running-engine-capacity factor . . .	55.0%
KW. hrs. per gal. fuel	11.7
Rated engine hp.per gal. lubricating oil	2064
Total 10-year cost of engine repairs .	$708.00
Average liner wear per 10,000 hrs.	15/10,000 inches

Total 10-year cost of generating power, including labor, fuel oil, lubricating oil, repairs and supplies, interest, amortization, overhead, taxes and insurance . . . *9.68 mills per KW. hr.*

WORTH BEHIND THE NAME
WORTHINGTON

DE 4-2

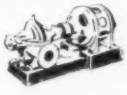
YOUR PARTNER IN POWER PROGRESS

WORTHINGTON-BUILT AUXILIARIES

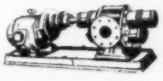
Evaporative Type Engine Water Cooler

Starting Air Compressors

Cooling Water Circulating Pumps



Oil Transfer Pumps

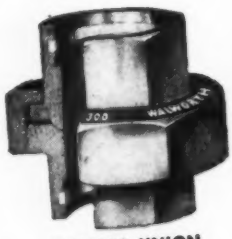


Diesel engines, 150 to 2,600 hp. . . . gas engines, 175 to 2,880 hp. . . . convertible fuel engines, 150 to 1,720 hp.

Leakproof SILBRAZ* *joints*

IN COPPER OR BRASS PIPE

with WALSEAL* fittings, flanges, valves

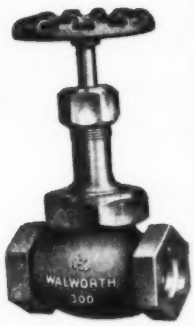


WALSEAL UNION

WALSEAL 90° ELBOW

WALSEAL Y BRANCH

WALSEAL TEE



WALSEAL GLOBE VALVE

WALSEAL CROSS

WALSEAL OPEN RETURN BEND

WALSEAL COUPLING

WALSEAL FLANGE

This illustration shows only a few of the many Walseal valves, fittings, and flanges made by Walworth.

Silbraz joints are the strongest joints that can be made on brass or copper pipe or tubing They cannot creep or pull apart under any temperature or pressure which the pipe or tubing itself can safely withstand.

Silbraz joints are easily made with an oxyacetylene torch. When alterations to the line are necessary, Silbraz joints can be taken apart by reheating with the torch The Walseal valves or fittings used for making Silbraz joints may be re-used in the same or a new position. Enough alloy usually remains in the insert groove of the valve or fitting to permit a second Silbraz joint to be made, without the necessity of inserting additional alloy.

Walseal valves, fittings, and flanges for making Silbraz joints are a modern development of the Walworth Company — manufacturers of valves and pipe fittings for more than a century. For detailed information about Walseal products, write for Circular 84. For information on Walworth's complete line of valves, fittings, pipe, and pipe wrenches write on your company letterhead for a free copy of Catalog 42

* Registered trade marks

One-Piece PIPE LINES

The above illustrates the details of a Walseal tee and Silbraz joints. The center port has been cut away to show the ring of silver brazing alloy which is inserted by the manufacturer in the ports of every Walseal product

The right-hand port has been cut away to show the penetration of the alloy after the pipe and fitting have been silver brazed.

The left side of the tee shows the fillet of silver brazing alloy which completely encircles the pipe at the juncture of pipe and fitting — indicating that the Silbraz joint is completed. Because the brazing alloy penetrates both pipe and fitting, the resulting Silbraz joint actually makes the pipe and fitting into a one-piece pipe line.

WALWORTH

valves and fittings

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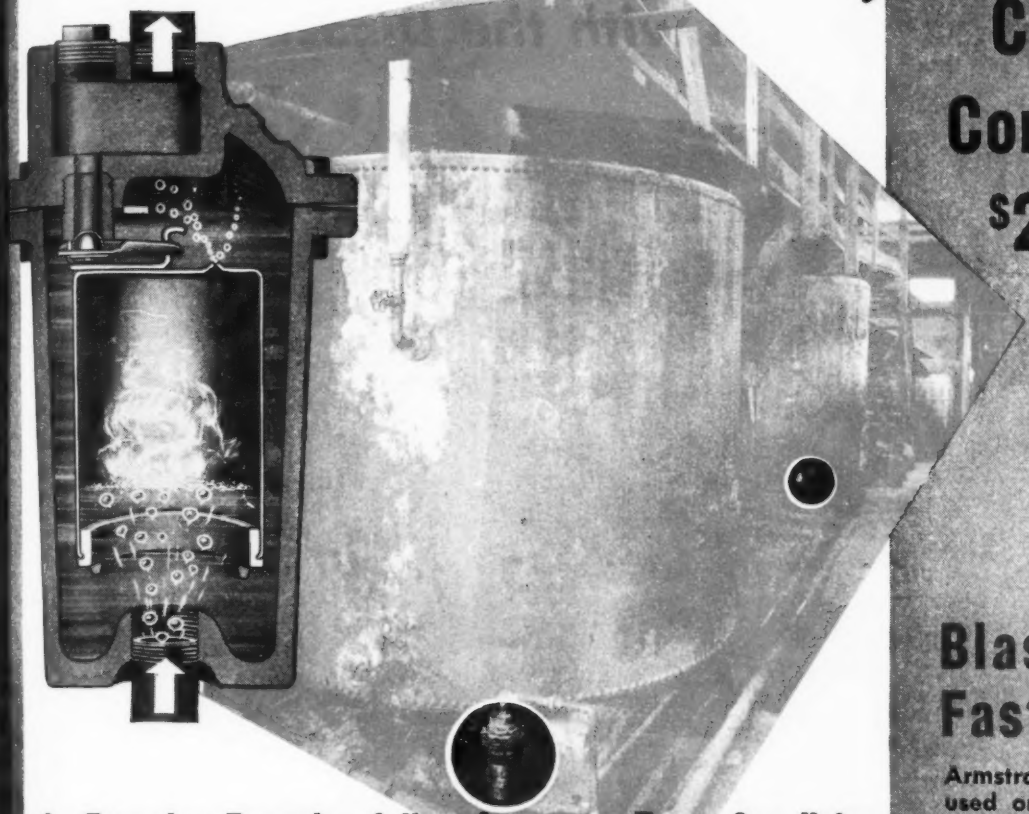


An Everyday Example of How Armstrong Traps Can Help U.S. Through Crisis in Fuel, Materials, and Manpower

The chemical company in question unit trapped each of 17 stills with Armstrong No. 215 traps and secured fuel savings that returned the cost of the installation within a month. But what is even more important today than the monetary return is the saving in manpower, fuel and materials and the possibilities of increased production.

Every engineer knows that *condensate* and *air* are the foes of efficient utilization of steam, yet these simple facts cannot be repeated too often!

Armstrong Traps remove all condensate and air as fast as it accumulates without steam leakage. This means that the steam gives up its heat where it is supposed to! And the result is, as has been *proved* in thousands of installations, that efficiency is increased anywhere from 10% to 50% or more in extreme cases.

The ability of Armstrong traps to do a complete trapping job is inherent in the inverted bucket design and Armstrong construction. Heat treated, ground and lapped chrome steel valves are steam tight. The valve is either open wide or closed tight so that wiredrawing common to partially open orifices is eliminated. Swirling action of condensate carries away ordinary dirt and scale — it cannot interfere with trap operation. Air passes through the vent in the bucket, collects at the top of the trap and is discharged with the condensate. Condensate is discharged regardless of temperature as soon as enough forms to sink the bucket.

These are some of the reasons why it pays to buy Armstrongs. Write for Catalog H, 3rd edition. It is a handbook of condensate drainage practice.

ARMSTRONG MACHINE WORKS, 812 Maple Street
Three Rivers, Michigan

ARMSTRONG INVERTED BUCKET STEAM TRAP

Armstrong

Blast Traps for Fast Heating...

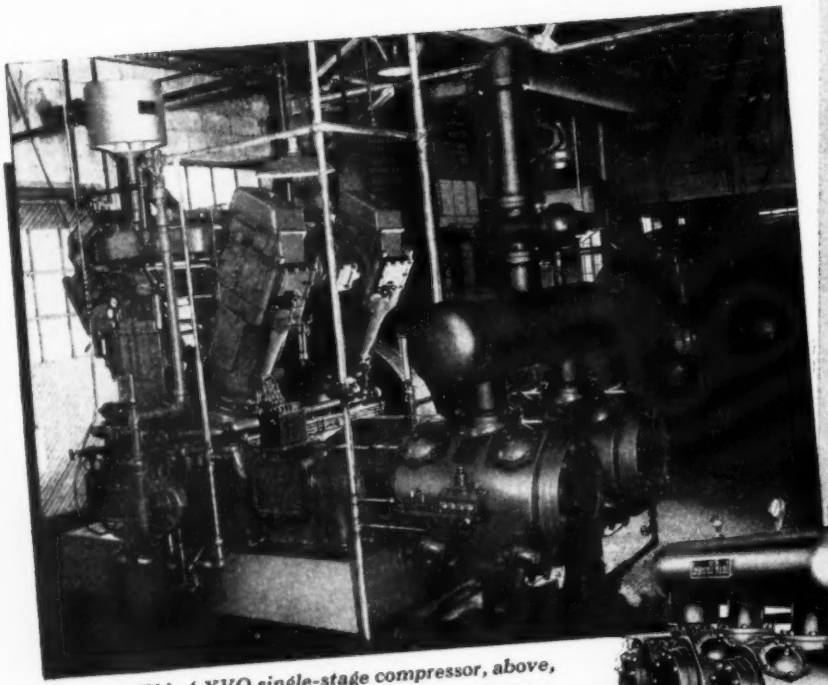
Armstrong Blast Traps are widely used on low pressure heating or "up-and-down" process units where large amounts of air must be removed quickly to permit faster heating. The blast type traps differ from a standard trap in that the inverted bucket is equipped with an auxiliary air vent which is controlled by a flat disc mounted at the end of a rustless, thermostatic bi-metal strip. When steam is first turned on, this auxiliary vent is wide open. Air and water blow straight through until steam comes in and causes the bi-metal strip to bend upward closing the auxiliary vent. The trap then works the same as a standard trap.

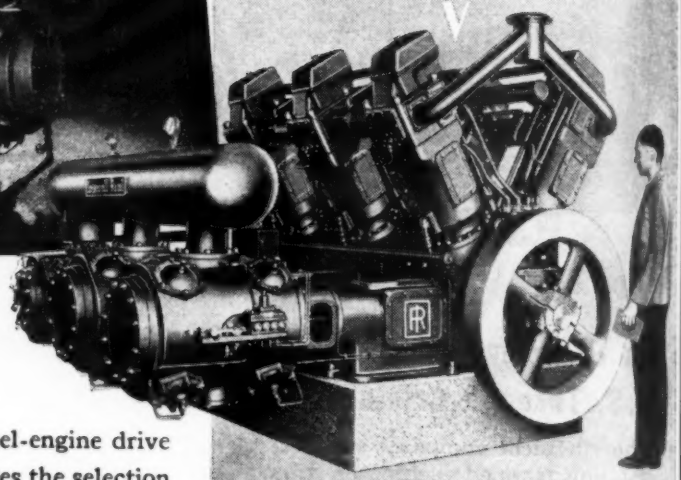
Thermic units can be supplied for any pressure. For high pressure process units, the auxiliary vent can be set to remain open to any desired temperature. Normally it is set to close at 212°. Capacity 50 to 100 times greater air venting capacity than the regular traps.

Maybe YOU *have compressor problems that can be solved with the* DIESEL-DRIVEN

TYPE
XVO

DIESEL ENGINE AND COMPRESSOR IN ONE MACHINE
UNIT DESIGN





This 4 XVO single-stage compressor, above, supplies medium-pressure air at a factory. At right is a 6 XVO two-stage compressor.

When economy dictates the selection of Diesel-engine drive for compressors, certainly the same reason dictates the selection of the most economical type.

One gallon of diesel fuel will compress 5600 cubic feet of free air to 100 pounds pressure . . . in an *XVO*. Compare this high over-all economy with any other compressor plant.

The XVO combines a heavy-duty, four-cycle diesel engine and a heavy-duty, double-acting compressor in a single, compact machine. It has fully demonstrated its ability to operate continuously at full load, 24 hours per day, over long periods of time . . . it was built for that purpose.

1 IF YOUR COMPRESSOR PLANT SHOULD BE INDEPENDENT OR ISOLATED.

2 IF ECONOMY IS A PRIMARY CONSIDERATION.

3 IF EXISTING POWER FACILITIES CANNOT CARRY ADDITIONAL LOAD.

Select the **XVO**

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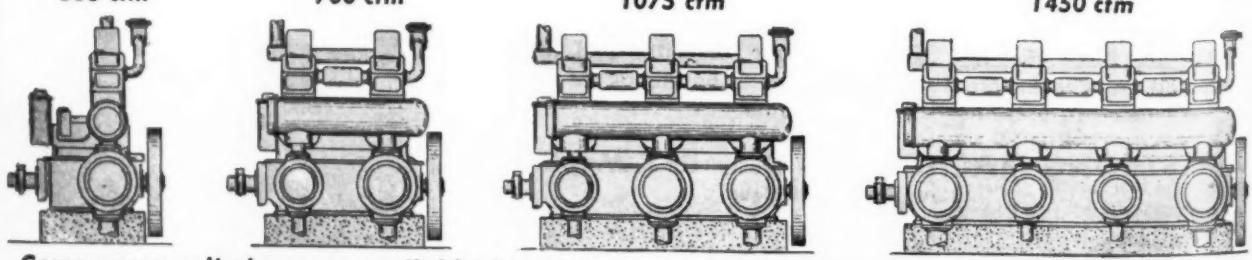
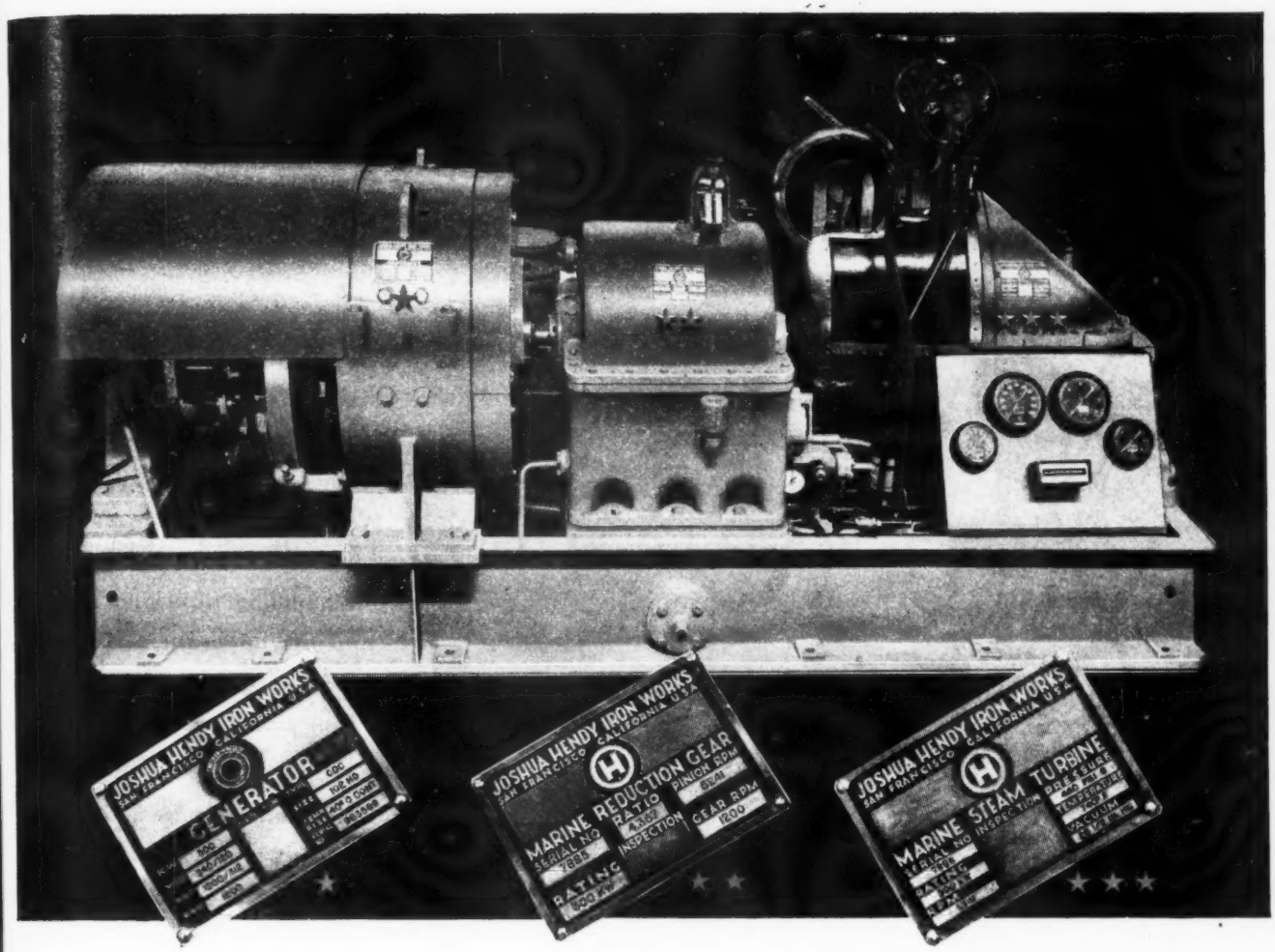
Cfm free-air actual delivery at 100-lb pressure and sea level

335 cfm *700 cfm* *1075 cfm* *1450 cfm*



Compressor cylinders are available for air, gas, and ammonia . . . for practically any pressures



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This turbo-generator set was designed as *one complete* power-generation set—not as three separate units. Turbine, reduction gear and generator—all three, Hendy-designed and Hendy-built to give you complete power equipment from one reliable source.

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The reduction gear, smooth and clean like the turbine, has its bull gear and pinion mounted in precision-type babbitt-lined bearings to guarantee quiet operation over long periods.

The conservatively rated generator, either a-c or d-c, assures smooth operation because of the unusually close dynamic balance of the armature.

Together, these three matched Hendy-built units form a turbo-generator set completely designed by experienced Hendy engineers, in a range of 250 to 750-kw, to give you the utmost in service for a wide variety of marine or industrial applications.

For complete data write for new catalog on Hendy Type HG-26 Auxiliary Turbo-Generator sets.

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Fuel economies, comfort and consequent increased efficiency of employees are but a few of the many outstanding advantages of Sylphon Automatic Radiator Valves.

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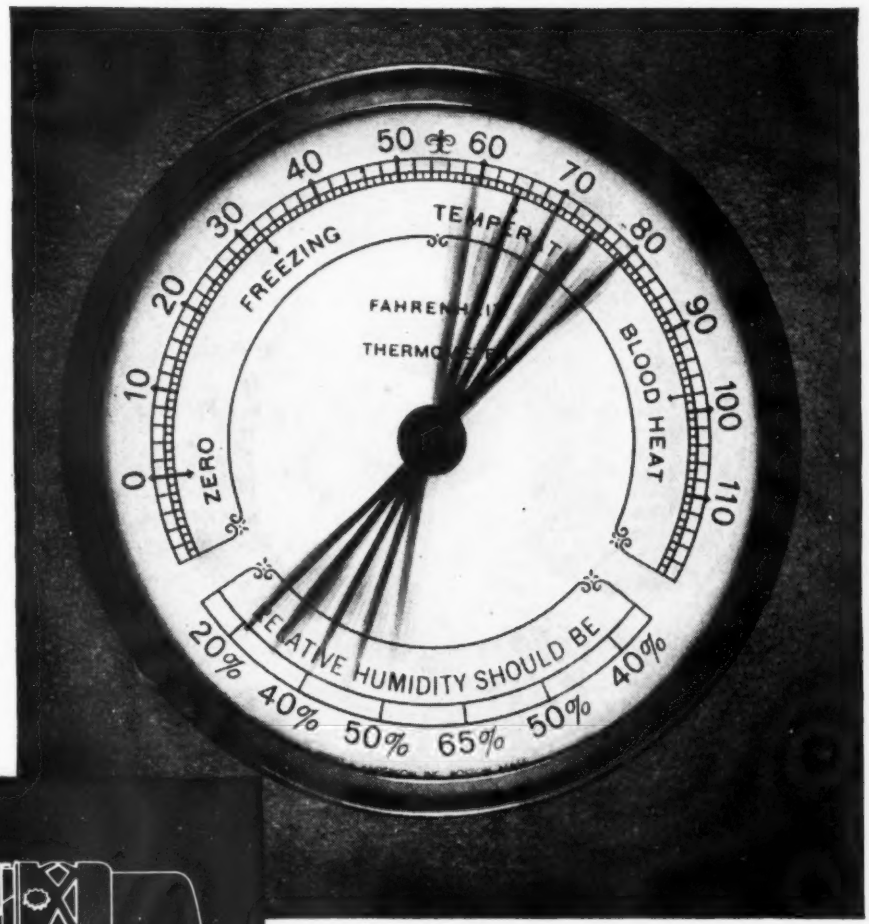
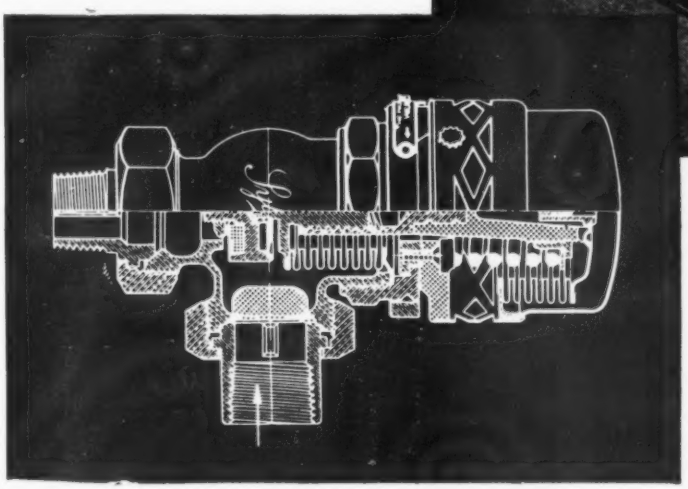
Send for bulletin TS-255.





No. 885 Sylphon Automatic Radiator Valve suitable for any two pipe steam, vapor or vacuum system. Designed so that it can be set at desired temperature and locked with a special key, to prevent tampering by unauthorized persons . . . The Fulton Sylphon Co. manufactures a complete line of automatic temperature control devices for heating, piping and air conditioning systems. Send for literature.

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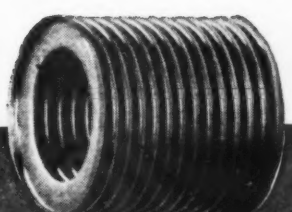

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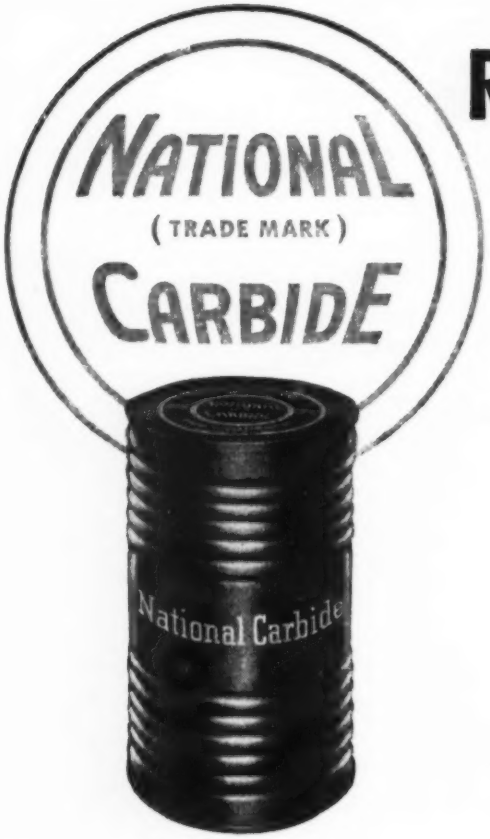

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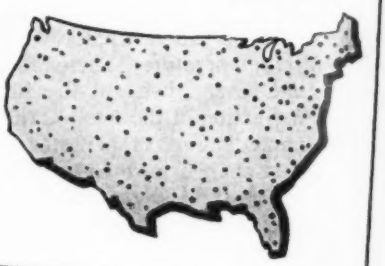

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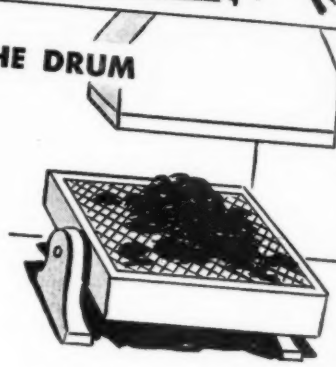

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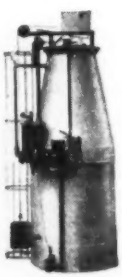

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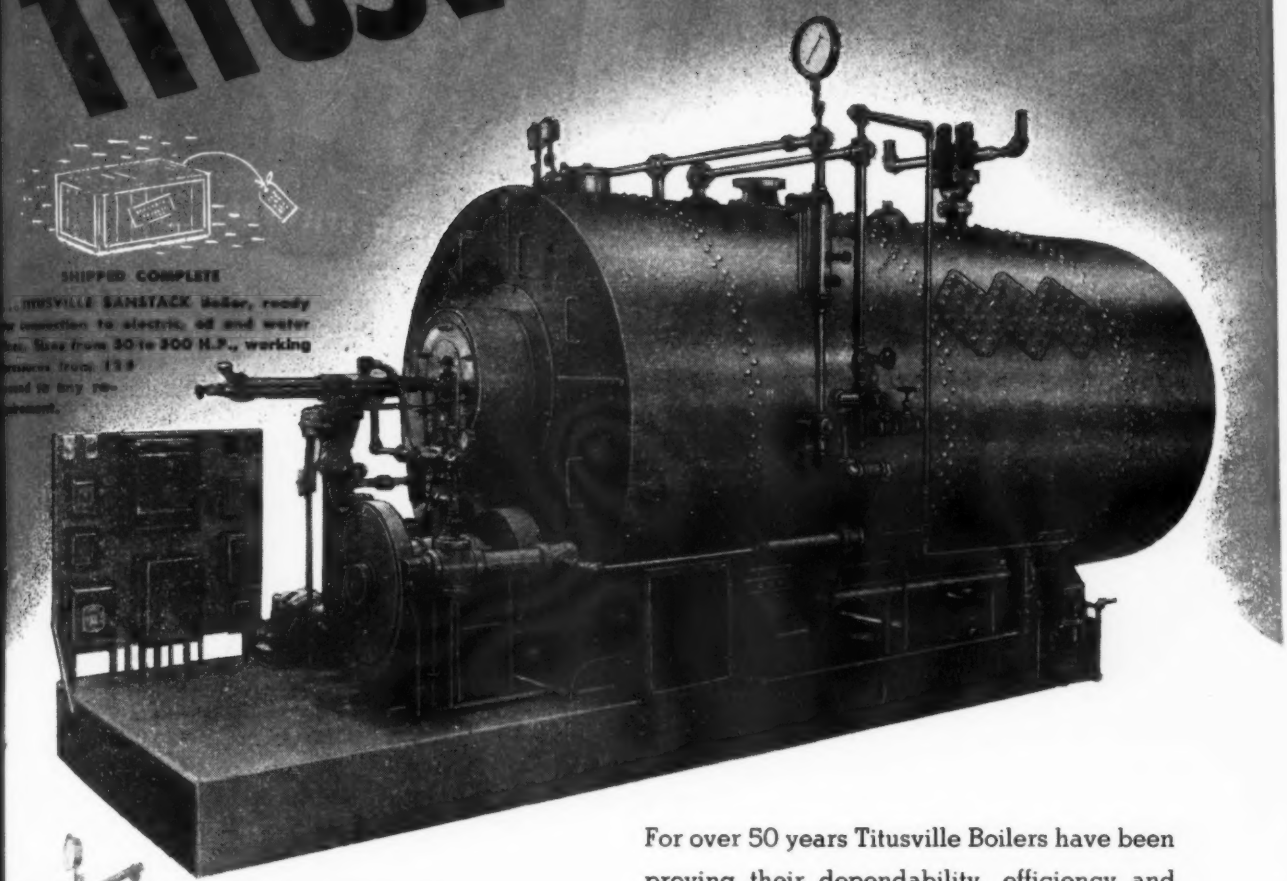

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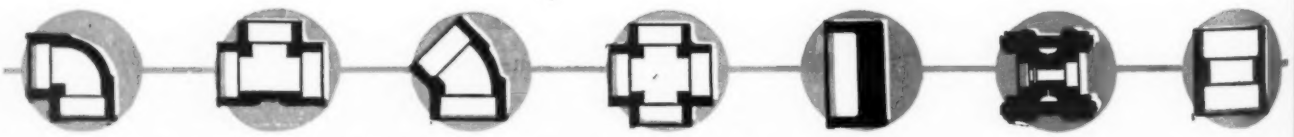

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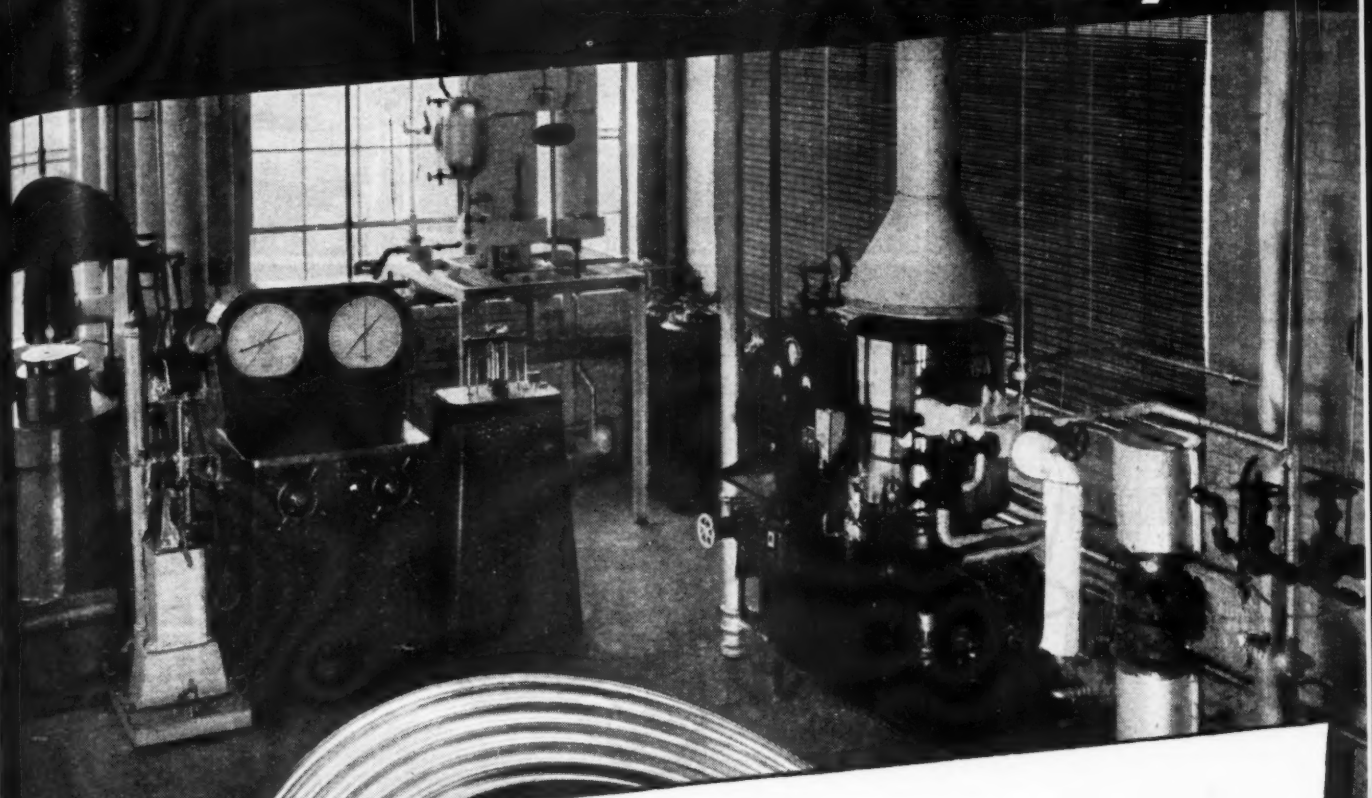

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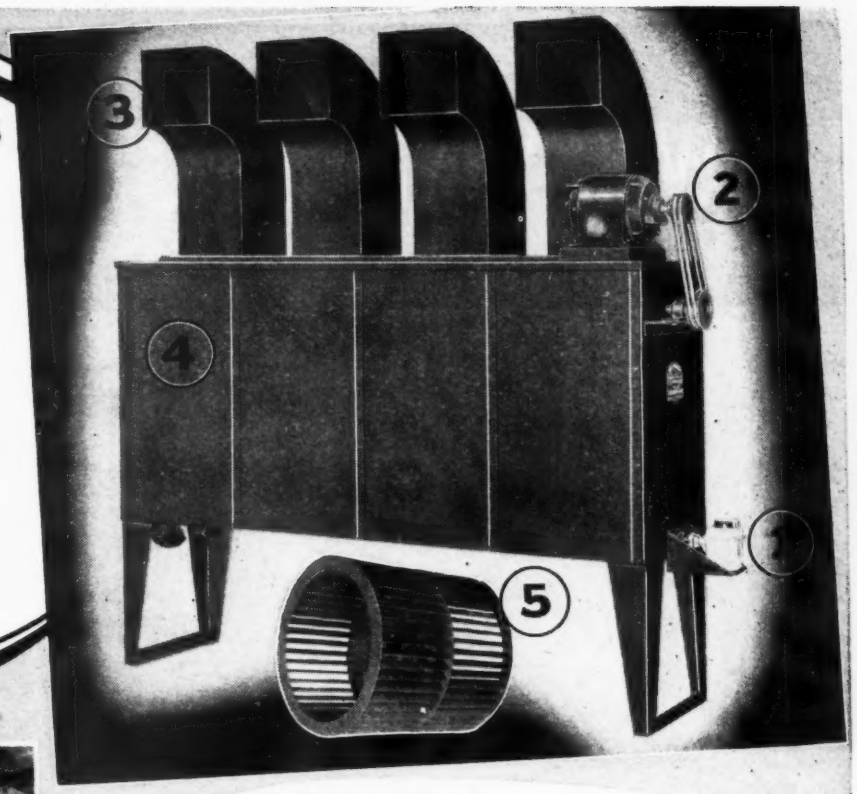
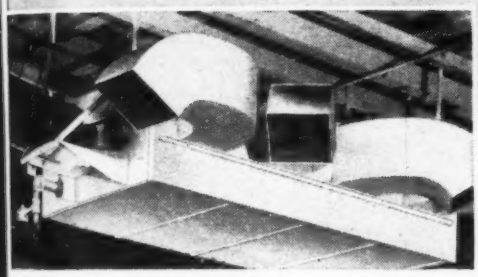
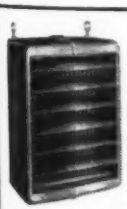
COSTS!





Floor or Ceiling Installation

Unitherm Heaters can be furnished either as floor or suspended type units. Floor type units are preferable where space permits. They are slightly more efficient in operation, and they simplify your layout considerably saving in pipe and trap costs. Suspended type units can be easily installed along walls or at ceiling line.



CLARCO HEATERS for SMALLER JOBS

These propeller type, suspended units are adaptable for small space heating and for places where more heat is required than present equipment can supply. Also suitable for heating offices and stores. Very quiet in operation. Easily installed along side walls or at ceiling line.

CLARAGE

Unitherm Heaters Offer:

1. **Syncrotherm Control:** temperatures regulated by the amounts of return air passing through or/and around heating coil. Constant warm air circulation; no stopping and starting of fans. Effective heating with LOWER temperature air; *important fuel savings.* Patented device obtainable only on Clarage Unitherm units.
2. **V-Belt Drive:** permits regulation of fan speed to meet widely varying conditions; insures QUIETER operation. (Direct drive if desired.)
3. **Square Outlets:** easily removable and adjustable for four different directions of heat flow.
4. **All Parts Readily Accessible:** merely remove front (or back) section of heater casing which is fastened to frame with machine screws.
5. **Centrifugal Fans:** one for each heater outlet. Pressure type delivering heat at high velocity over wide areas.

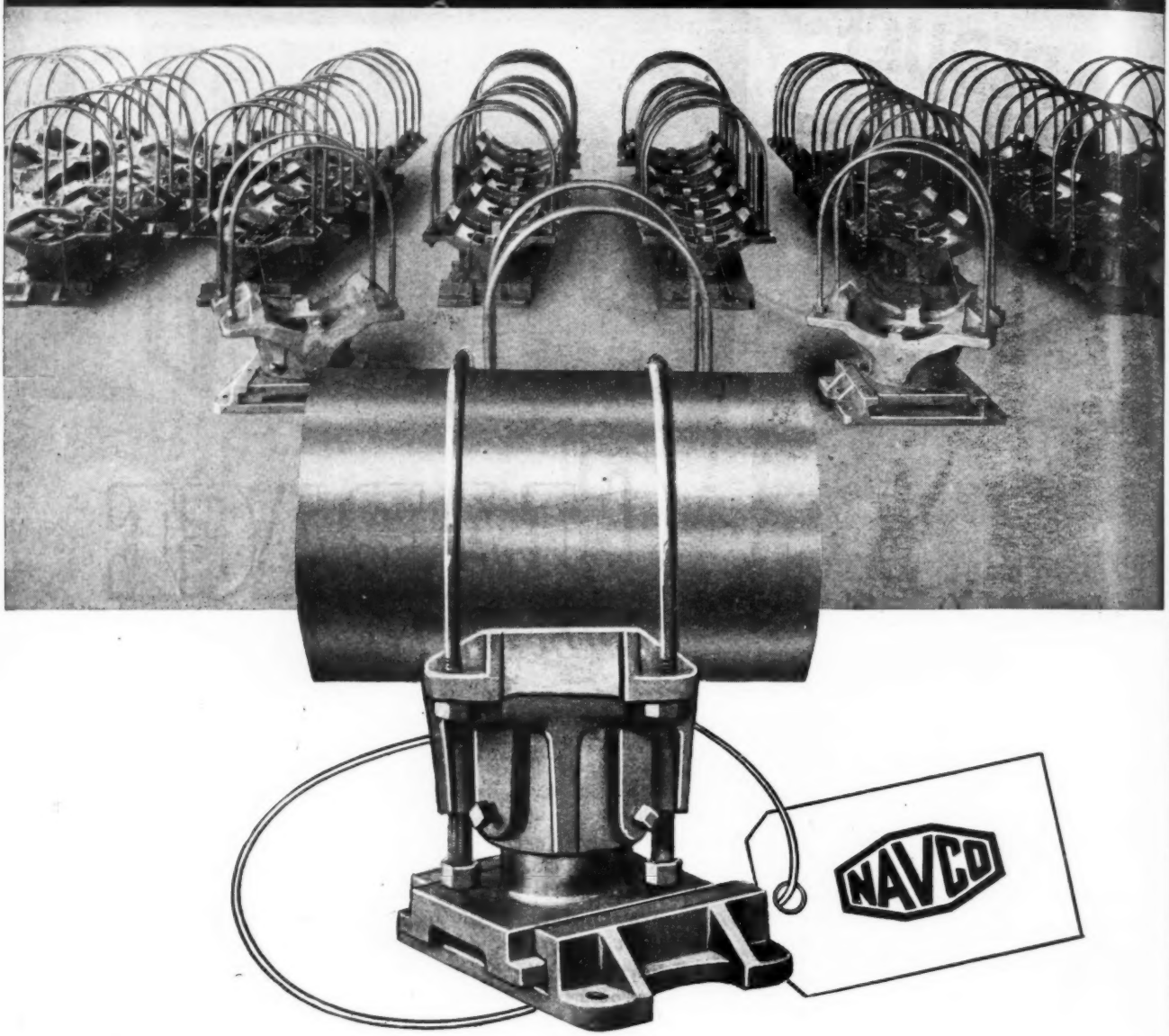
*Liberal range of sizes to meet all kinds of industrial heating jobs, operating on steam or hot water. Prompt deliveries. Have Clarage engineers submit complete recommendation. Write or phone us today!

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

Clarage Fan Company Kalamazoo 16, Mich.

APPLICATION ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

NAVCO "UNIVERSAL" PIPE SUPPORTS



Navco Universal Support will take care of eight inches of expansion and can be made special to accommodate any amount of travel.

Vertical adjustment up to 2½ inches can be made.

Support may be turned to any angle of 360°.

Holds pipe down as well as up. Prevents pipe from getting out of alignment, which is usual in the Roller Type of support.

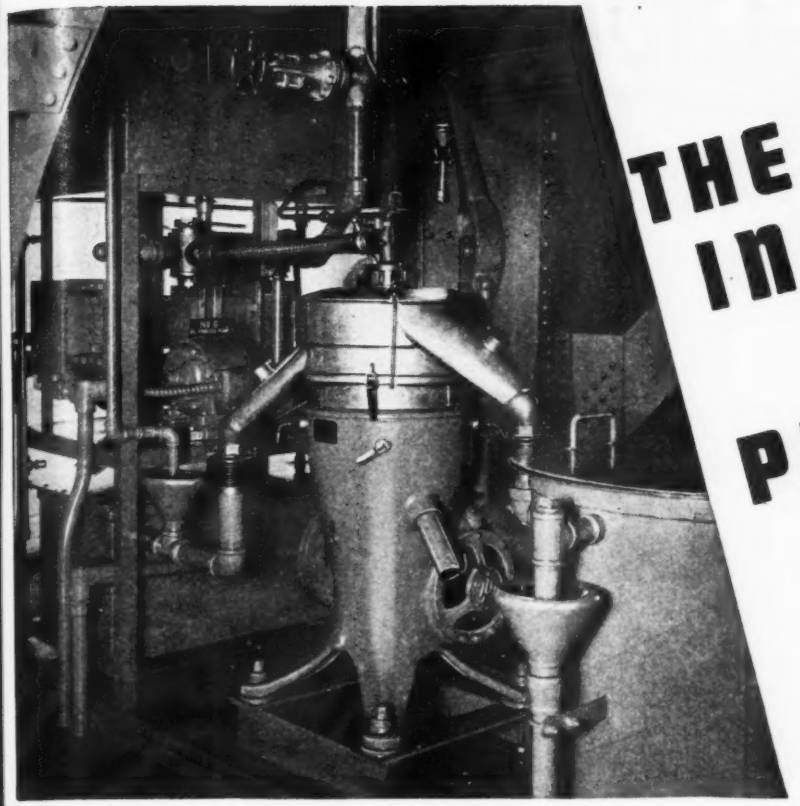
It permits control of expansion movement of pipe and insures the desired free action of Slip Expansion Joints so essential in tunnel and duct work.

Carrier is fixed to a predetermined point on the pipe, thereby eliminating possibility of destroying insulation. There is a recess in the saddle for insulation and the entire support can be insulated on the outside.

Navco Universal Pipe Supports are made of cast iron but can also be furnished in steel at increased prices. For installations exposed to the weather, bases can be furnished with brass liners or provided with forced lubrication.

NATIONAL VALVE & MANUFACTURING COMPANY • PITTSBURGH, PA.

ATLANTA BUFFALO CLEVELAND CHICAGO NEW YORK PHILADELPHIA



THE ULTIMATE IN TURBINE OIL PROTECTION

A DE LAVAL-FUNK PROCESS

THE De Laval-Funk Process is the "last word" in turbine oil protection because it is the most effective means of (1) minimizing the formation of sludge within the lubricating system and (2) continuously purifying the oil. As sludge is generally recognized to be the real trouble maker in turbine oil lubrication, the De Laval-Funk Process helps check trouble at its source. Moreover, since an adequate supply of clean oil is the best safeguard known against bearing trouble, the De Laval Centrifugal which is the purification unit of the Process provides the ultimate in protection against such failures.

Whether the particular power plant calls for a De Laval-Funk Process or simply a De Laval Oil Purifier to keep the lubricating oil free from dangerous impurities and water, there is a wide range of capacities available from which to choose. Regardless of size or capacity, all De Laval Centrifugal Oil Purifiers maintain the oil in a condition most nearly identical with that of new oil, and make possible long, trouble-free service. Write for complete information.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 19
THE DE LAVAL COMPANY, Limited
MONTREAL PETERBOROUGH WINNIPEG VANCOUVER

DE LAVAL OIL PURIFIERS

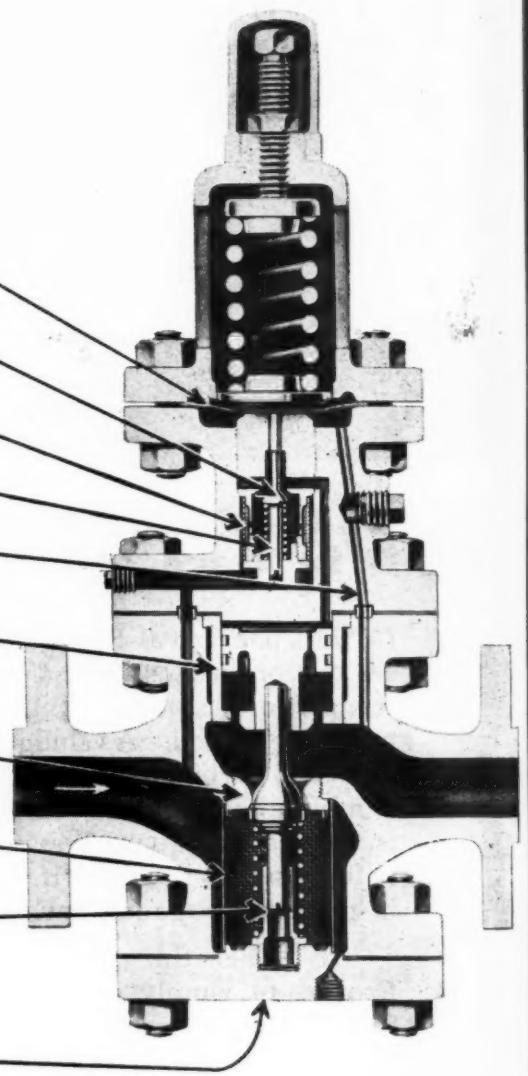
FOR MORE DEPENDABLE POWER PRODUCTION

FOSTER REGULATION ENGINEERING

Saves Maintenance Time

for example:

1. Diaphragm unit can be removed without disturbing rest of valve
2. Auxiliary valve is small—easily ground
3. Entire auxiliary valve unit protected by strainer
4. Auxiliary units interchangeable for all sizes from ½" to 4"; 4½" to 10"
5. All ports internal—protected against damage
6. Cylinder liner replaceable
7. Main valve seat ring replaceable
8. Main valve protected by strainer
9. Lower guide bushing replaceable
10. Major overhaul, when necessary, without breaking the line



Foster Type G2S Pilot Operated Reducing Valve for Steam Service

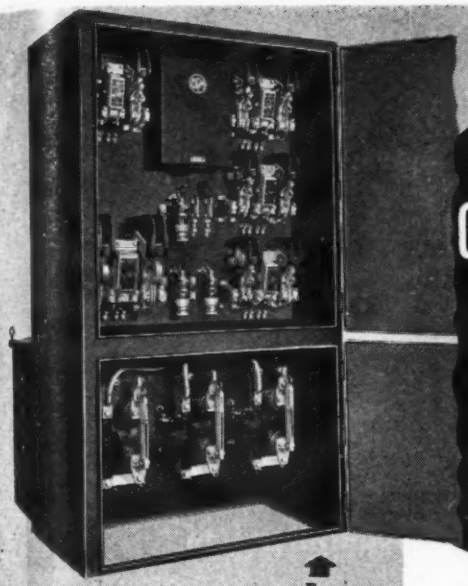
Foster Regulation Engineering, built into each valve, is your assurance of years of accurate trouble free operation.

★ BUY MORE BONDS ★

FOSTER ENGINEERING Company

PRESSURE REGULATORS...RELIEF AND BACK PRESSURE VALVES...AUTOMATIC STOP AND CHECK VALVES...ALTITUDE VALVES...DAMPER REGULATORS...FAN ENGINE REGULATORS...PUMP GOVERNORS...TEMPERATURE REGULATORS...LIQUID LEVEL CONTROLLERS...FLOAT AND LEVER BALANCED VALVES...NON-RETURN AND TRIPLE DUTY VALVES...VACUUM REGULATORS OR BREAKERS...SIGHT FLOW BOXES...STRAINERS...SAFETY VALVES...SIRENS

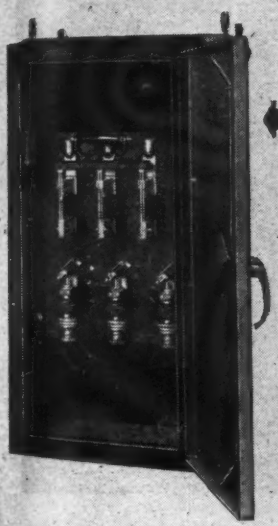
106 MONROE STREET • NEWARK 1, N. J.



ALL EC&M COMBINATION STARTERS ARE SAFE!

TOTALLY ENCLOSED-DOOR INTERLOCKED

For WOUND-ROTOR MOTORS
2300 Volt Complete Starter



Reduced Voltage Squirrel-Cage Starter, 600 volts or less.

For SQUIRREL-CAGE or SYNCHRONOUS MOTORS

Above: Full Voltage Starter for 2300 or 4600 volt motors. At left: 600 volt or less Full Voltage Starter.

WITH these EC&M combination starters you not only save ordering time, installation time, and materials, but also get shock-proof, safe units which can be mounted in a control room or out in the plant alongside the motors they control.

Each is completely wired, totally enclosed and equipped with interlock on the disconnect switch door. This small but important feature eliminates the danger of shock or burns to inexperienced help and also safeguards against the momentary mental lapse of an older employee.

EC&M builds these starters for all types of motors, for voltages up to 4600 volts, as well as for full or reduced voltage starting. Fill in the coupon below, checking the type of control suited to your needs and full information will be sent promptly. No obligation, of course.

FILL IN AND MAIL COUPON TODAY

THE ELECTRIC CONTROLLER & MFG. CO.
2700 East 79th St. Cleveland 4, Ohio

Gentlemen:
Please send me information on EC&M Combination Starters for

Reduced.....or Full.....voltage starting of a.....H.P., ...Volt Motor (Sq. Cage....., Wound-Rotor....., Synchronous.....)

Name.....

Company.....

Address.....

"FOR 23 YEARS THIS ENGINE HAS DELIVERED EFFICIENT, DEPENDABLE PERFORMANCE WITH Gulf Parvis Oil —"

says this Superintendent

Actual photo of a Gulf Service Engineer consulting with Superintendent on Diesel engine lubrication.

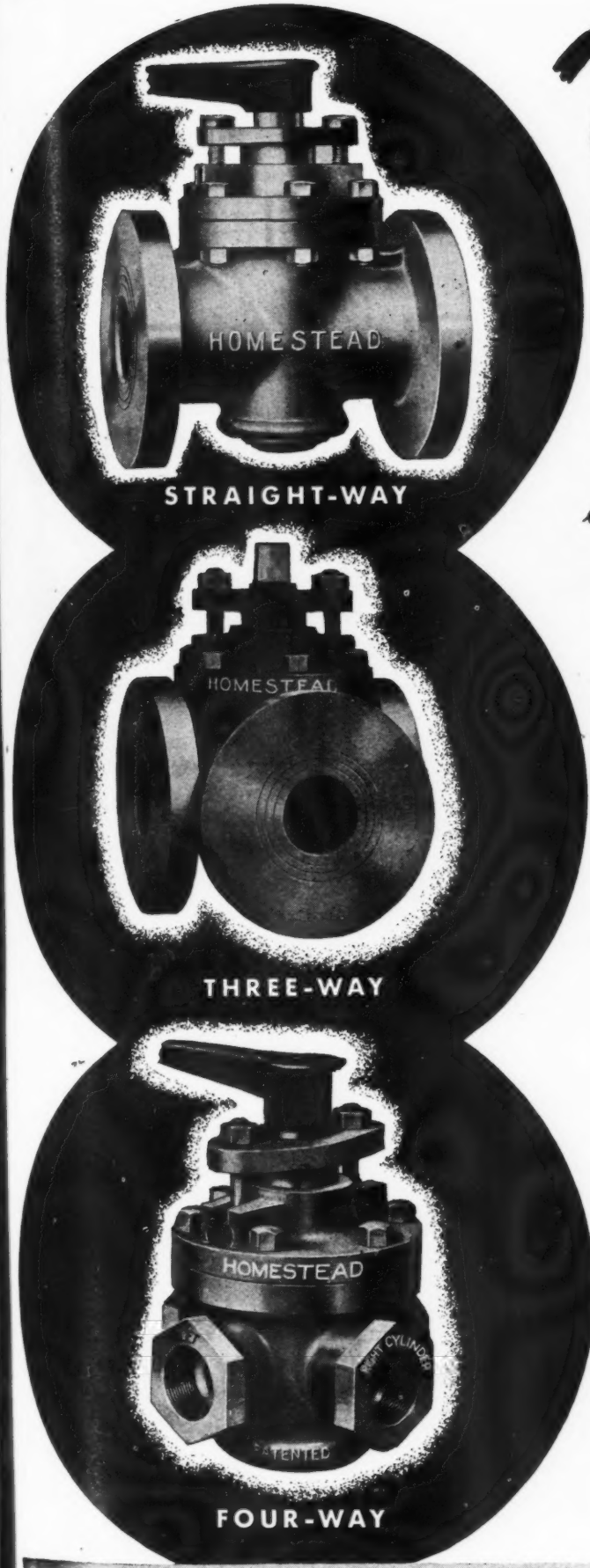
"This engine has operated efficiently and dependably since it was installed in 1921—and the high quality of Gulf Parvis Oil has been an important factor in this outstanding performance," says the Superintendent of the Mexia, Texas municipal power plant. "Proper lubrication has paid us big dividends for 23 years—our maintenance costs have been remarkably low, and we have a record of uninterrupted service to our customers."

There are good reasons for the outstanding performance of Gulf Parvis Oil in hundreds of Diesel engines. This higher quality lubricant is manufactured from selected crude oils by the most modern refining methods. And built into it is superior lubricating value and longer life—two assets that insure less wear, lower maintenance costs, and efficient, dependable Diesel operation.

If you are not one of the hundreds of enthusiastic users of Gulf Parvis Oil, it will pay you to investigate—call in a Gulf Lubrication Service Engineer and ask him to recommend the proper grade to fit your particular requirements. Write, wire, or phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING, PITTSBURGH 30, PA.



You Get

INSTANT ACTION

POSITIVE CONTROL

LOWER UPKEEP

LONGER SERVICE

with HOMESTEAD Quarter-Turn Valves

INSTANT ACTION because a Quarter-Turn *fully opens* or *closes* these valves. They operate 16 to 28 times *faster* than screw-stem types.

POSITIVE FLUID CONTROL because cam presses seating surfaces firmly together in closed position, yet valve operates freely. Sealed bottom, bonnet and stem, prevent wasteful, outside leakage.

LOWER UPKEEP AND LONGER SERVICE because seating surfaces are protected in the closed position and turned completely out of the fluid path in the open position. Thus shielded from corrosion or erosion by fluids, longer life is assured.

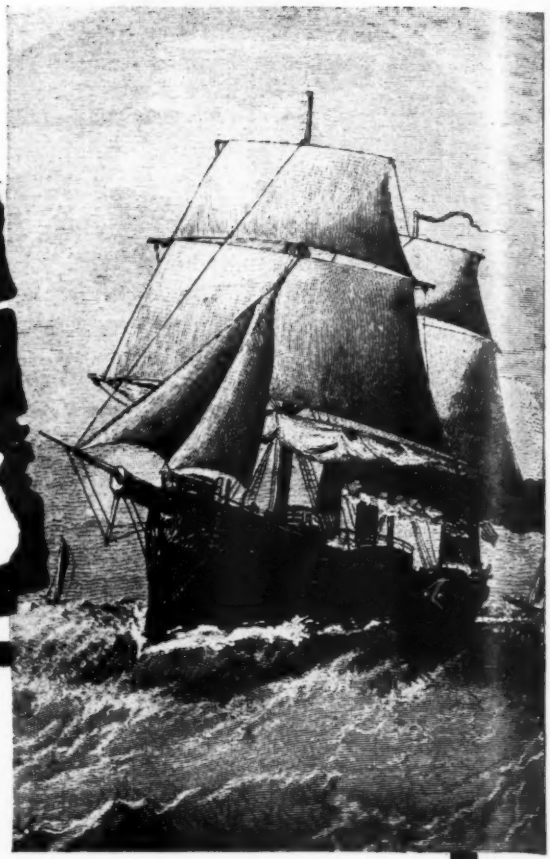
HOMESTEAD QUARTER-TURN VALVES are made in sizes, types and metals for most of your valve needs; for pressures to 3000 pounds and temperatures to 750 degrees F. Consult our engineering department for special valves designed to your own specifications. Write for copy of Valve Reference Book No. 38.

Maritime's two-flag, highest production award to our men and women making valves for the Victory Fleet.

HOMESTEAD VALVE MFG. CO.

P. O. BOX 210, CORAOPOLIS, PENNSYLVANIA

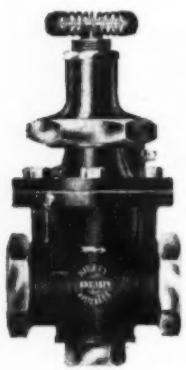
THIS WAS A MIGHTY MAN-O-WAR



Launched in 1886, the Chicago *was ultra-modern in her day. Her armament included 5", 6" and 8" guns, 12 rapid fire guns, and 1 "breech-loading rifle." She was 4500 tons; developed 5084 HP.*

There were only 38 states in the Union the year the *Chicago* was launched. Telephones were a novelty; electric light a new-born experiment. But no longer experimental was the K&M Steam Trap. Introduced in 1879, it was a good trap—the "daddy" of all traps.

This is K&M's 64th year devoted exclusively to designing and building steam specialties and controls. In World Wars I and II we have earned citations from the government. In wartime and in peace we have earned the endorsement of American industry.



The cumulative experience of our 64 years is clearly evident in the fine valves and traps we manufacture today. For instance, type 481A, the very compact pressure reducing valve for inlet pressures to 250 lbs., and reduced pressures of 2 lbs. to 80% of inlet. Type 481, similar, is self-contained; requires no control line.

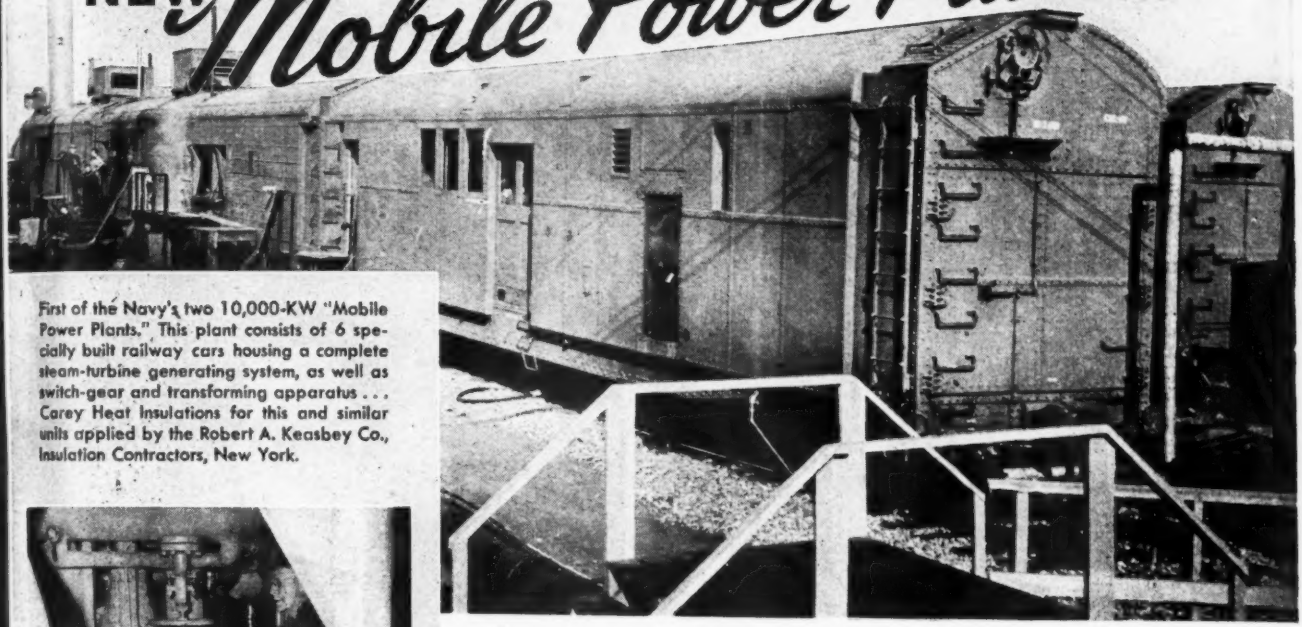
The factory-trained K&M representative in your territory will be glad to discuss with you the applications of these or any other of the more than 100 K&M valves, traps and controls. Write for General Catalog 66.

KIELEY & MUELLER, INC.
MANUFACTURERS OF PRESSURE AND LEVEL CONTROLS SINCE 1879
NORTH BERGEN, NEW JERSEY

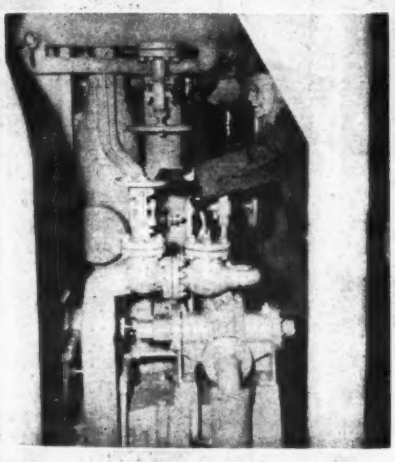
★ ★ Carey HEAT INSULATIONS ★ ★

ASSURE TOP EFFICIENCY IN *Navy Department's*

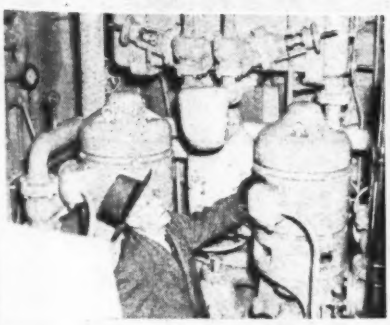
NEW *Mobile Power Plants*



First of the Navy's two 10,000-KW "Mobile Power Plants." This plant consists of 6 specially built railway cars housing a complete steam-turbine generating system, as well as switch-gear and transforming apparatus . . . Carey Heat Insulations for this and similar units applied by the Robert A. Keasbey Co., Insulation Contractors, New York.



Carey-Insulated valve and pump assembly, for feeding water to steam tubes of boiler. (U. S. Navy Photo)



The turbine-generator car contains an amazingly compact arrangement of steam power plant apparatus—all Carey-Insulated. (U. S. Navy Photo.)

THEY neither float nor fly . . . yet these new "Mobile Power Plants," mounted on specially designed cars which travel over railroad tracks, will perform important work for the U. S. Navy at home.

This 10,000-KW power-plant-on-wheels was conceived, designed, and financed by the Navy Department's Bureau of Yards and Docks. The detailed design was then developed by the General Electric Company, under supervision of the Bureau.

General Electric has supplied two of these 6-car, 10,000-KW plants, for use on domestic projects. They can be quickly transported by rail to any point where additional or emergency power is needed.

Also, similar Mobile Plants of 3000 and 1000-KW capacity, supplied by General Electric, will be used in *rebuilding war-devastated areas abroad.*

Obviously, heat insulation for these units must be of highest efficiency and dependability. Selection of Carey 85% Magnesia and Carey Hi-Temp Insulation for many of these units assures maximum power production from minimum fuel—the same top performance which industrial and power plants the nation over attain with these *always reliable* Insulations.

For details on Carey Heat Insulations, designed for all temperatures from sub-zero to 2500° F., write Dept. 16.

THE PHILIP CAREY MFG. COMPANY

Dependable Products Since 1873

LOCKLAND, CINCINNATI 15, OHIO

In Canada: **The Philip Carey Company, Ltd.** *Office and Factory:* **Lennoxville, P. Q.**

"NO BOILER-SCALE OR CORROSION HERE... GOOD WATER TAKES CARE OF THAT!"

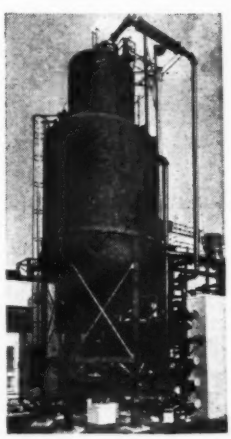
THOUSANDS of war plants are doing a better job for Uncle Sam because of good water—delivered by Permutit* equipment. Permutit removes the water impurities that cause slowdowns and destruction of critical equipment.

Permutit provides *every* process for controlling water quality . . . including Deaerating Heaters, Hot and Cold Lime Soda Water Softeners, Zeo-Karb* Water Conditioners, Silica Removal, Continuous Blowoff and the Demineralizing Process that produces a low-cost substitute for distilled water.

Let Permutit help work out *your* water problem. Write to The Permutit Company, Dept. A, 330 West 42nd St., New York 18, N. Y. In Canada: Permutit Company of Canada, Ltd., Montreal.

*Trademark Reg. U. S. Pat. Off.

Permutit Deaerating Heater prevents corrosion, removes all oxygen and free CO_2 from feedwater. Designed for pressures up to 100 pounds or higher, capacities to 1,400,000 pounds per hour or higher. Utilizes bled or exhaust steam.

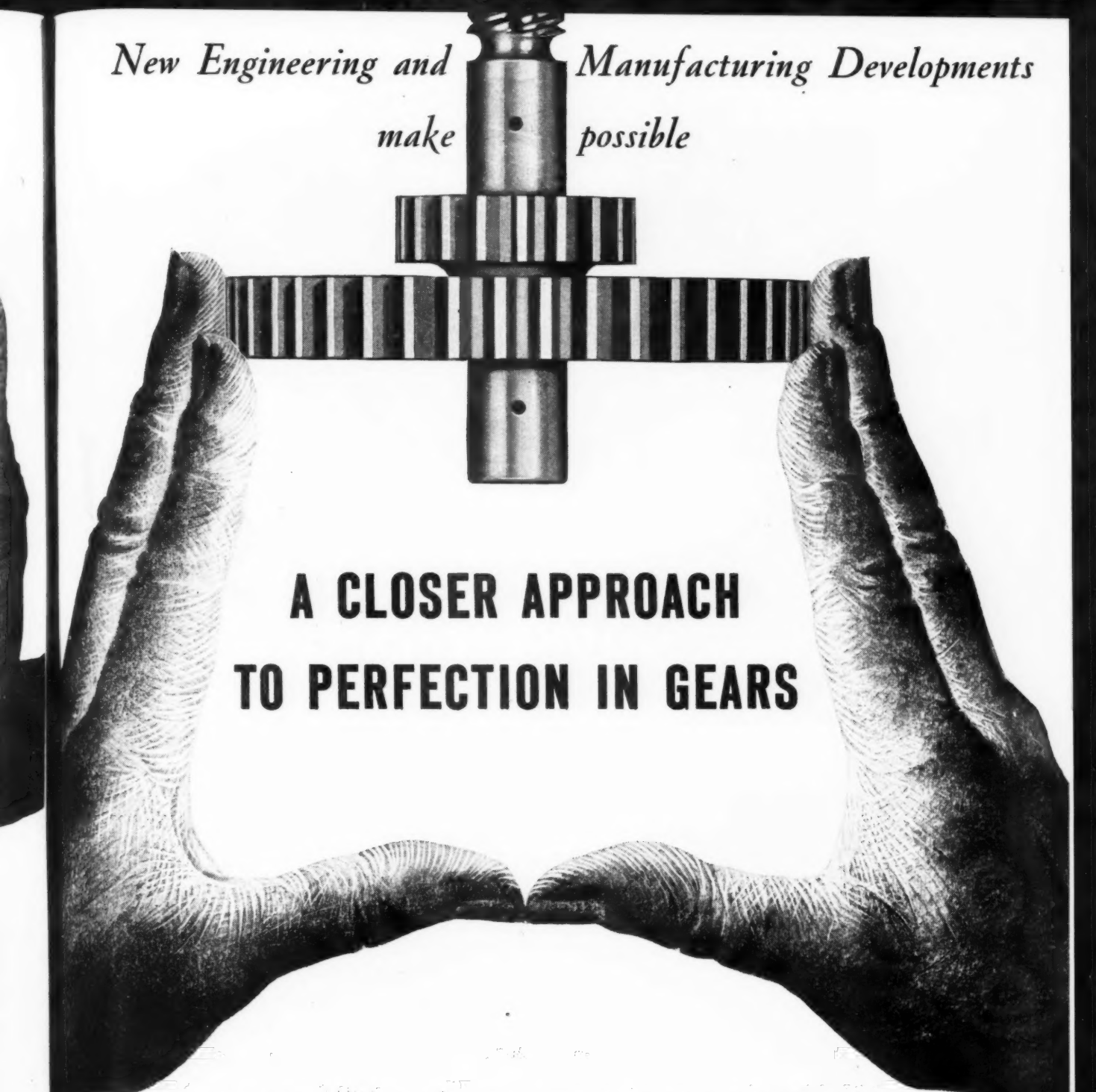


PERMUTIT

Serving industry and the armed forces... with GOOD WATER

WATER CONDITIONING HEADQUARTERS

New Engineering and Manufacturing Developments make possible



A CLOSER APPROACH TO PERFECTION IN GEARS

FOOTE BROS. "aircraft quality" gears offer the major advantages of greater mechanical efficiency, lighter weight, longer life, greater compactness and quieter operation.

Before war demanded the production of high precision gears in tremendous quantities, it was possible to attain such extreme precision only by laboratory methods—mass production was deemed impossible.

Today at the plants of Foote Bros., these "aircraft quality" gears in quantities sufficient to power the world's greatest air armada are rolling off production lines—each dimension held to an amazingly close tolerance. Such production has meant a new approach to gear manufacturing techniques.

If the machines or equipment you plan to produce when the war is won requires gears, these new developments will offer you new advantages in the economical transmission of power.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5225 South Western Boulevard • Chicago 9, Illinois

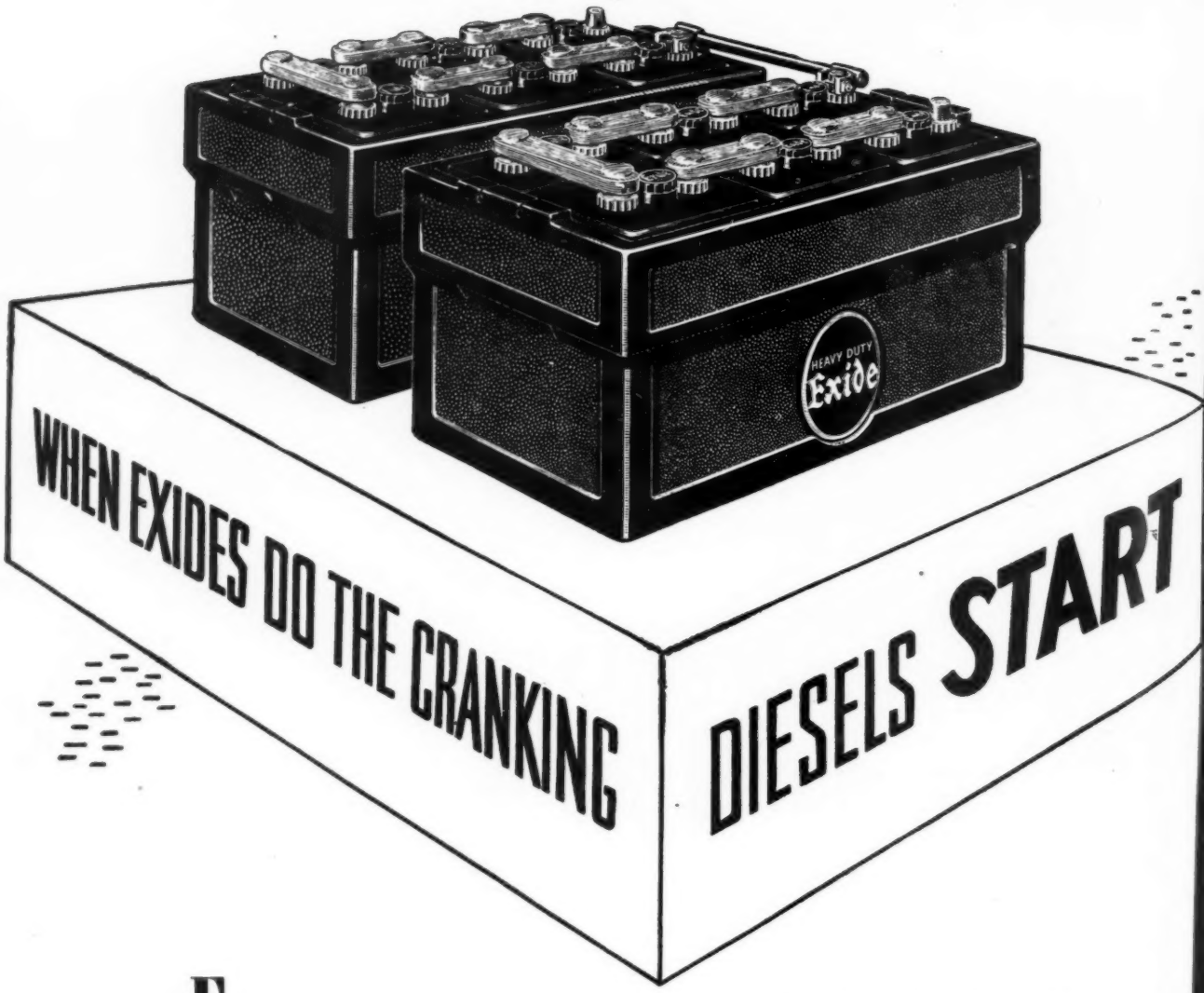
A booklet containing information and engineering data on "aircraft quality" gears is now being prepared. If you would like to have a copy as soon as it is ready, ask for one.

FOOTE BROS.

Better Power Transmission Through Better Gears

FOOTE BROS. GEAR AND MACHINE CORPORATION
PO-10 5225 S. Western Blvd., Chicago 9, Illinois
Please send me a copy of the Engineering Bulletin on "Aircraft Quality" Gears as soon as it is available.

Name.....*Position*.....
Company.....
Address.....
City.....*State*.....



EXIDE BATTERIES for Diesel engine cranking are specially designed and powered to handle this toughest of cranking jobs. And they are doing this dependably, day after day, even where climates and working conditions are exceptionally severe.

It takes high power and voltage to provide the speed needed to crank a Diesel engine. Exides have what it takes. And into every Exide Battery there is built a structural ruggedness that assures dependable performance, a long life and ease of maintenance. For quicker, surer starting delegate your Diesel cranking jobs to Exides.

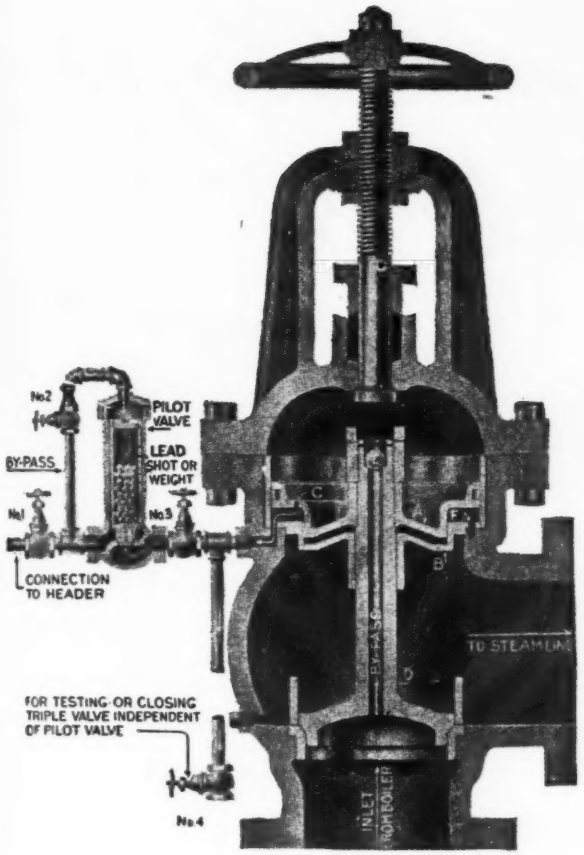
Write for FREE copy of the Exide Catalog on Heavy-Duty Batteries. It gives you catalog data on how to order and how to get the most from your Exide Heavy-Duty Batteries.

ARMY E NAVY

Exide
BATTERIES
FOR CRANKING
DIESEL ENGINES

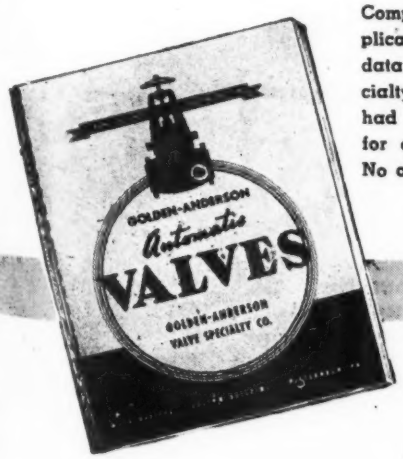
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

PRESSURE-DROP WON'T AFFECT YOUR OPERATIONS IF YOU PUT THE GAVSCO TRIPLE-ACTING NON-RETURN VALVE ON THE JOB!



GAVSCO Triple-Acting Non-Return Valves are available in Angle, Globe and Elbow patterns . . . sizes from 2½ to 14 inches, to handle pressures ranging from 300 to 900 lbs. All are furnished in double extra-heavy construction. Trim may be Bronze, Monel, Stainless Steel or Gallavoy, with option of having seat ring and disc Stellited.

Insure your operations against "down-time" with the GAVSCO Triple-Acting Non-Return Valve. It's a special service unit, developed to afford positive protection against damage from line ruptures and explosion by cutting in the boiler before boiler pressure equals line-header pressure. It works in reverse too—and will isolate the boiler whenever boiler pressure is lower than line-header pressure. In addition, if there is a sudden drop in line-header pressure this valve will prevent steam flow from the boiler.



Complete, specific application and operation data on GAVSCO Specialty Valves may be had by writing today for our latest catalog. No obligation.

GOLDEN-ANDERSON
VALVE SPECIALTY CO.
FULTON BLDG. PITTSBURGH, PA.

TO THOSE WHO ARE ASKING THIS QUESTION:

How soon can boiler plants be modernized?

THE ANSWER IS *RIGHT NOW . . .* if the oil or gas burning equipment you are using wastes fuel, or is incapable of producing maximum boiler rating. Hundreds of plants throughout the country already have modernized their costly, inefficient boiler rooms by the installation of Todd burners. And today Todd engineers are cooperating with the owners of many others on plans for modernization.

The importance of power plant efficiency is emphasized by today's need for peak war production. Todd liquid and gaseous combustion equipment conserves fuel, steps up power production—and thereby cuts the cost of a pound of steam.

Commercial and industrial plants using Todd burners report fuel savings ranging up to 10% and more, and corresponding power increases. Efficient boiler room operation will be a factor of special importance in the competitive years ahead. That's why forward-looking power engineers know that NOW IS THE TIME TO MODERNIZE—WITH TODD!

ARMY E NAVY

COMBUSTION EQUIPMENT DIVISION
TODD SHIPYARDS CORPORATION
601 West 26th Street, New York 1, N. Y.

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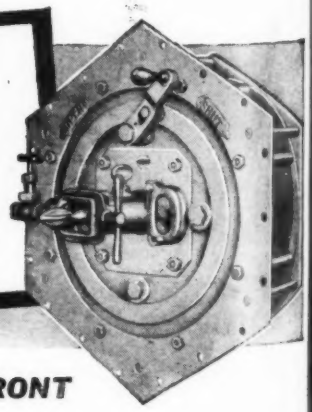
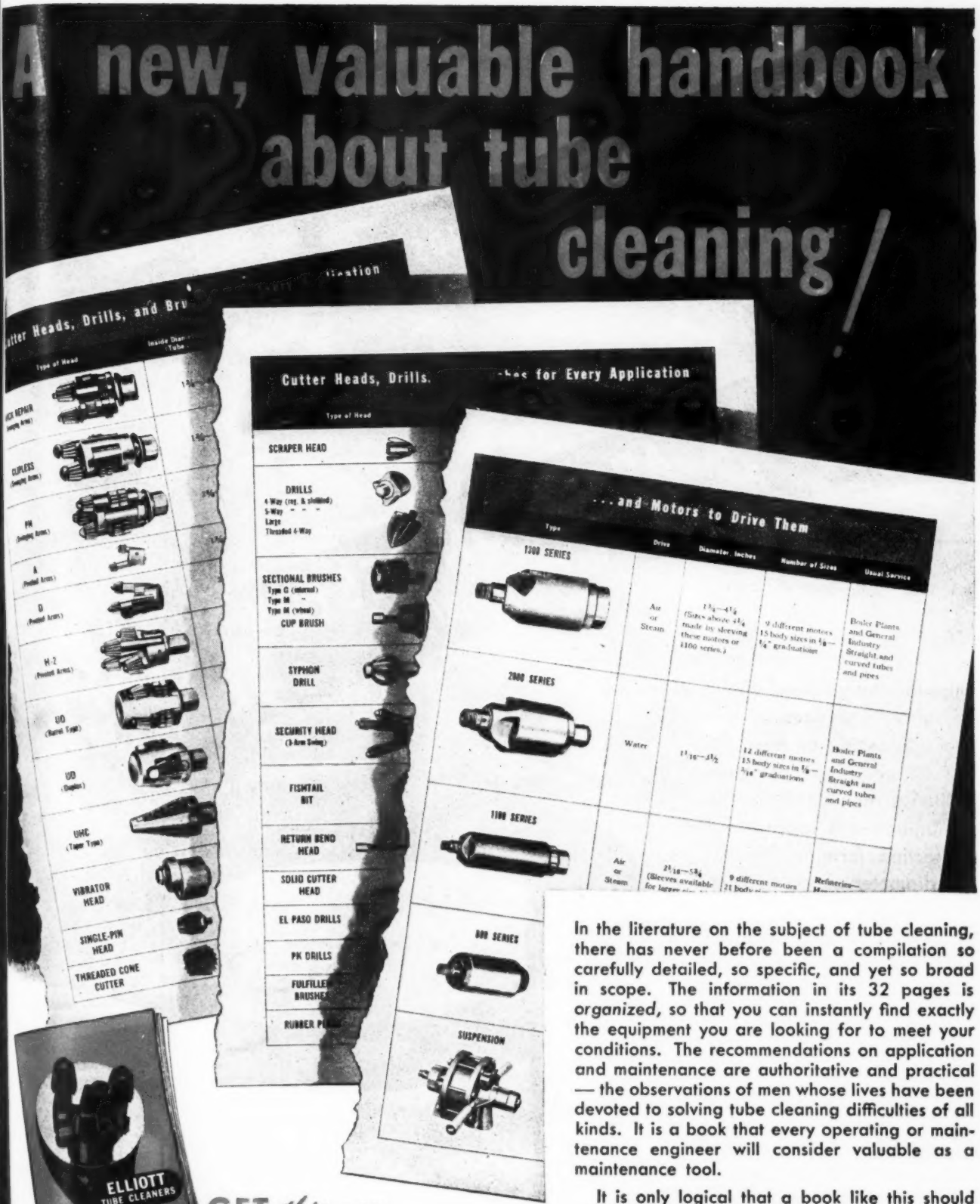


ON THE FIRING LINE OF AMERICA'S WAR PRODUCTION FRONT

A new, valuable handbook about tube cleaning!



In the literature on the subject of tube cleaning, there has never before been a compilation so carefully detailed, so specific, and yet so broad in scope. The information in its 32 pages is organized, so that you can instantly find exactly the equipment you are looking for to meet your conditions. The recommendations on application and maintenance are authoritative and practical — the observations of men whose lives have been devoted to solving tube cleaning difficulties of all kinds. It is a book that every operating or maintenance engineer will consider valuable as a maintenance tool.

It is only logical that a book like this should come from "Tube Cleaning Headquarters" — the Tube Cleaning Division of Elliott Company. We are glad to offer it. The coupon will bring a copy.

GET *this new tube cleaning book by*

ELLIOTT

Y-230

ELLIOTT COMPANY
Tube Cleaner Department, Springfield, Ohio
Send me the new Bulletin Y-18 on Tube Cleaners.

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COMPANY_____
ADDRESS_____

HAVING TROUBLE INSULATING BENDS?

SIMPLY APPLY UNIBESTOS
it's simple to apply!

Unibestos, the sectional insulation for all pipe sizes, permits easy application on even the most difficult-to-insulate expansion bends. Makes a clean, neat job. Unibestos is available in half-section form up to 30" pipe diameter and in quarter-sections from 32" to 60", in thicknesses from ¾" to 5". Available in single layer construction for service up to 1200°.

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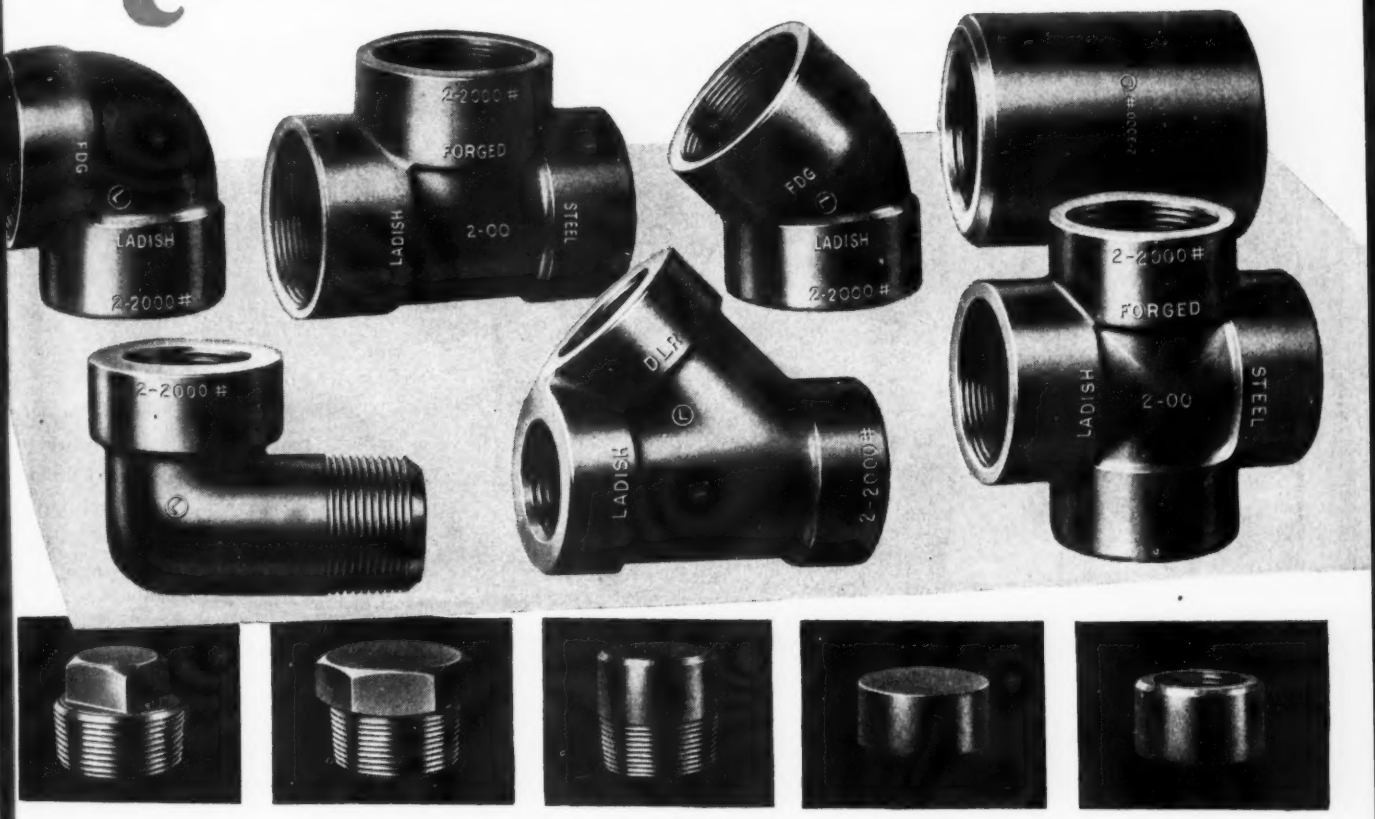
LADISH *Controlled Quality*

Forged Steel Pipe Fittings



• **The complete line of Ladish Forged Steel Pipe Fittings manufactured under the same *Controlled Quality* procedures that characterize all Ladish products is available to you in Carbon and Alloy Steel. Pressures from 2000 to 6000 lbs.**

Forged Steel Screwed Fittings

Full depth thread, accurately cut, results in pressure-tight joints. Pipe enters easily. Uniform thickness. Sizes clearly marked . . . ¼" through 4".

Socket Welding Fittings

Speed up installation because deep sockets save time formerly required to cut pipe to exact length. Socket supports pipe and allows self-alignment. No machining of pipe necessary for fit. ASSURED WELDABILITY. Sizes clearly marked . . . ¼" through 4".

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FITTINGS DIVISION

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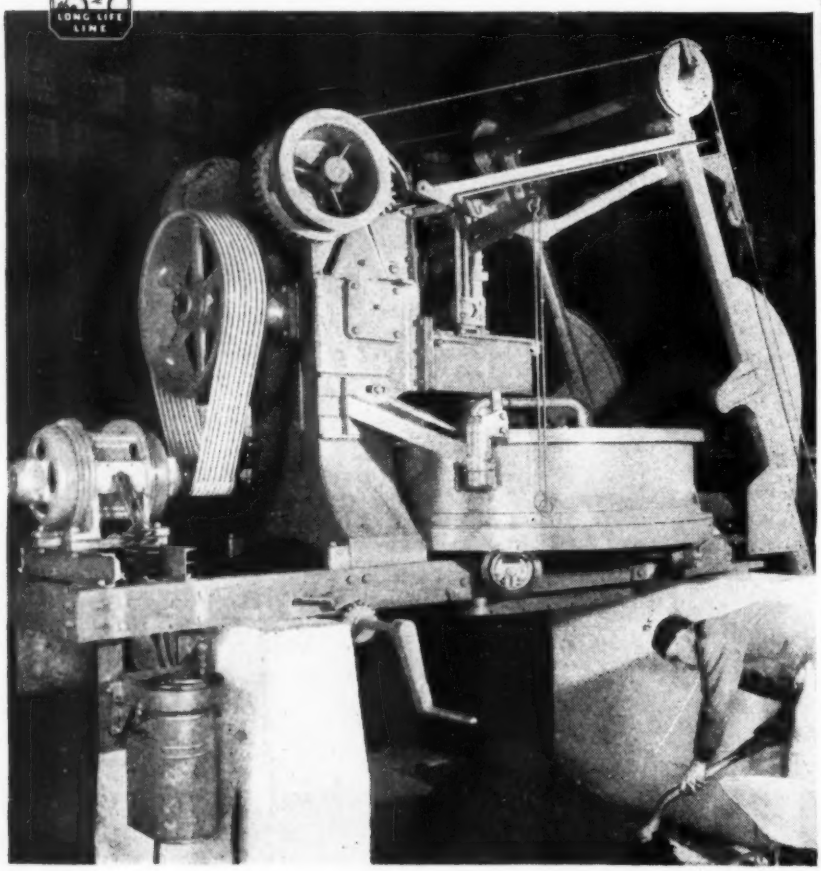
Both facing and core sands are being mixed in this Symbol EA-4 "Lancaster" Mixer, open pan type fitted with elevator hopper. Photo from Lancaster Iron Works, Inc., Lancaster, Pa.



Wood's V-BELT DRIVES

Here we have a WOOD'S V-Belt Drive on a "Lancaster" Mixer, used in the preparation of foundry sands. A 10 H. P. motor of 1200 r.p.m. provides 246 r.p.m. on the drive shaft of the mixer. V-Belt Drive is a most effective solution of the transmission problem involving high speed motors and low speed machinery.

V-BELT DRIVES•*EFFICIENT•POWERFUL•ECONOMICAL*

In any application of power transmission from source to driven machinery, V-Belt Drive will show maximum performance with minimum power loss and low maintenance costs.

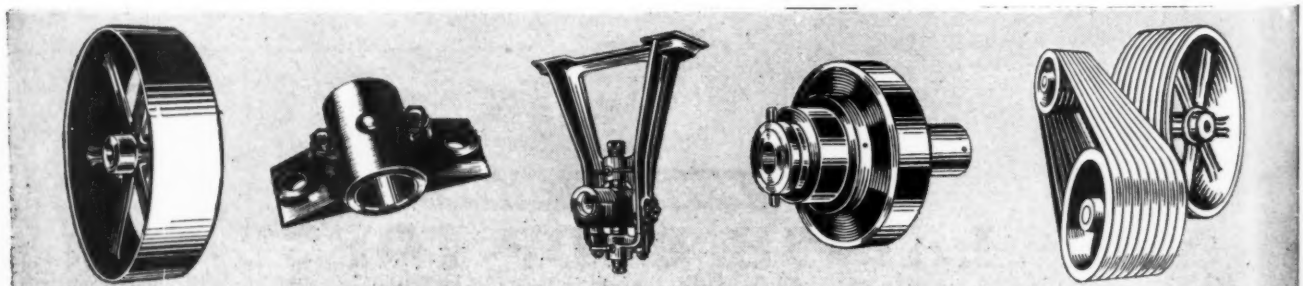
V-Belt power transmission utilizing flexible, resilient, full molded belts and Wood's sheaves with precision machined, accurately spaced, perfectly designed grooves, is V-Belt Drive at its best.

The benefit of Wood's pioneering experience in 87 years service to American industry, can be yours. Send for our 64-page V-Belt catalog. It describes Wood's V-Belt Drives in detail . . . including dimensions and weight tables of stock and standard sheaves, engineering tables and formulae to assist in selecting the correct drives to suit any requirements.

Engineering consultation welcomed . . . no obligation.

EVERYTHING IN TRANSMISSION

Bearings — Collars — Clutches — Couplings — Contactors — Hangers — Pillow Blocks — Pulleys — V-Belt Sheaves and Complete Drives



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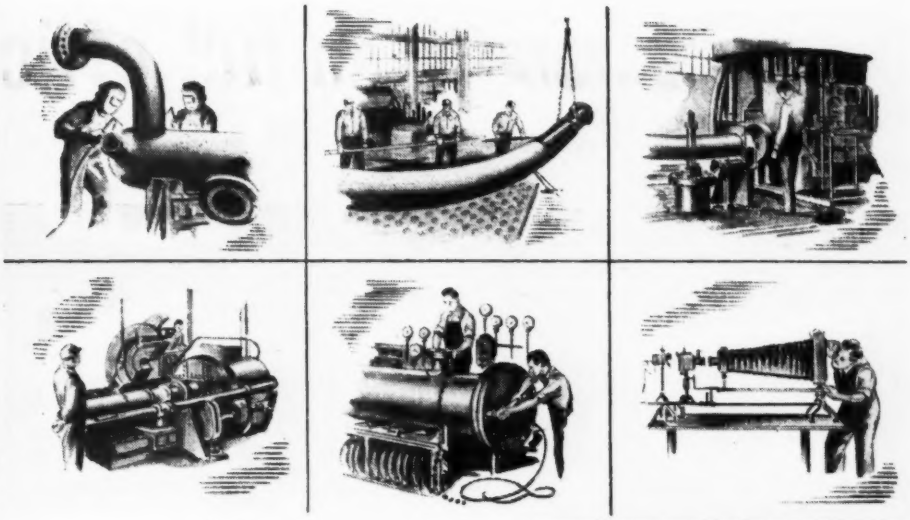
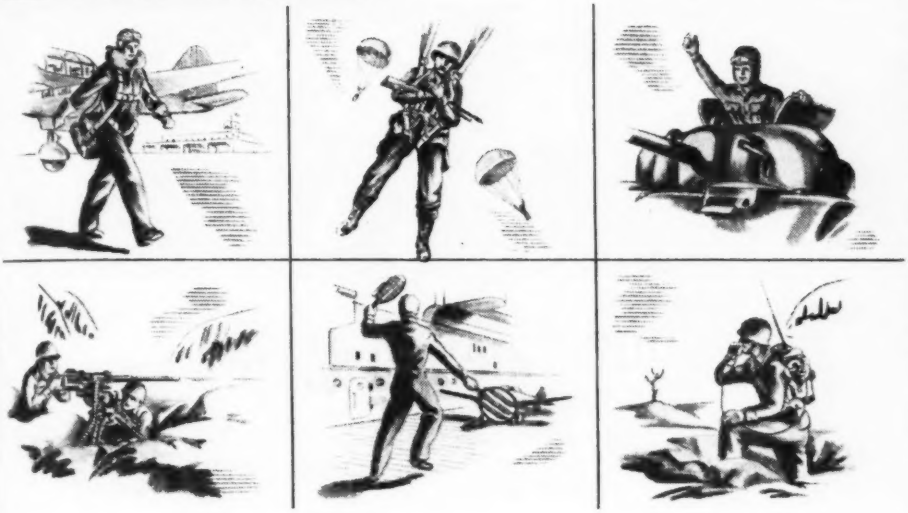
On the PIPING FRONT





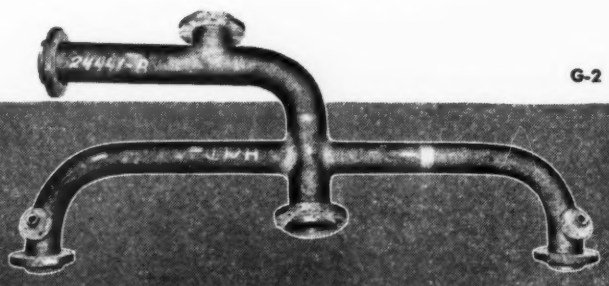
as on the FIGHTING FRONT

The armed forces include a long list of specialists: aviators, paratroopers, tank drivers, artillerymen, walkie-talkie operators, etc.—all received highly specialized training so that they can do their vital jobs correctly.

The piping front also depends upon specialists. Welders, benders, machinists, lapping machine operators, metallurgists, research engineers, radiograph technicians, furnace operators, etc. have had specialized training in the plants of qualified pipe fabricators.

These piping specialists, plus the specialized equipment (such as rotating fixtures, and jigs for welding, straightening tables, etc.) available in fabricating plants, enabled qualified fabricators to do an outstanding job in meeting the tremendous demand for piping in the great industrial conversion to war production.

This is a War of SPECIALISTS



G-2

THE PIPE FABRICATION INSTITUTE

P.F.I. *Devoted to the Technical and Economic Problems in Piping*

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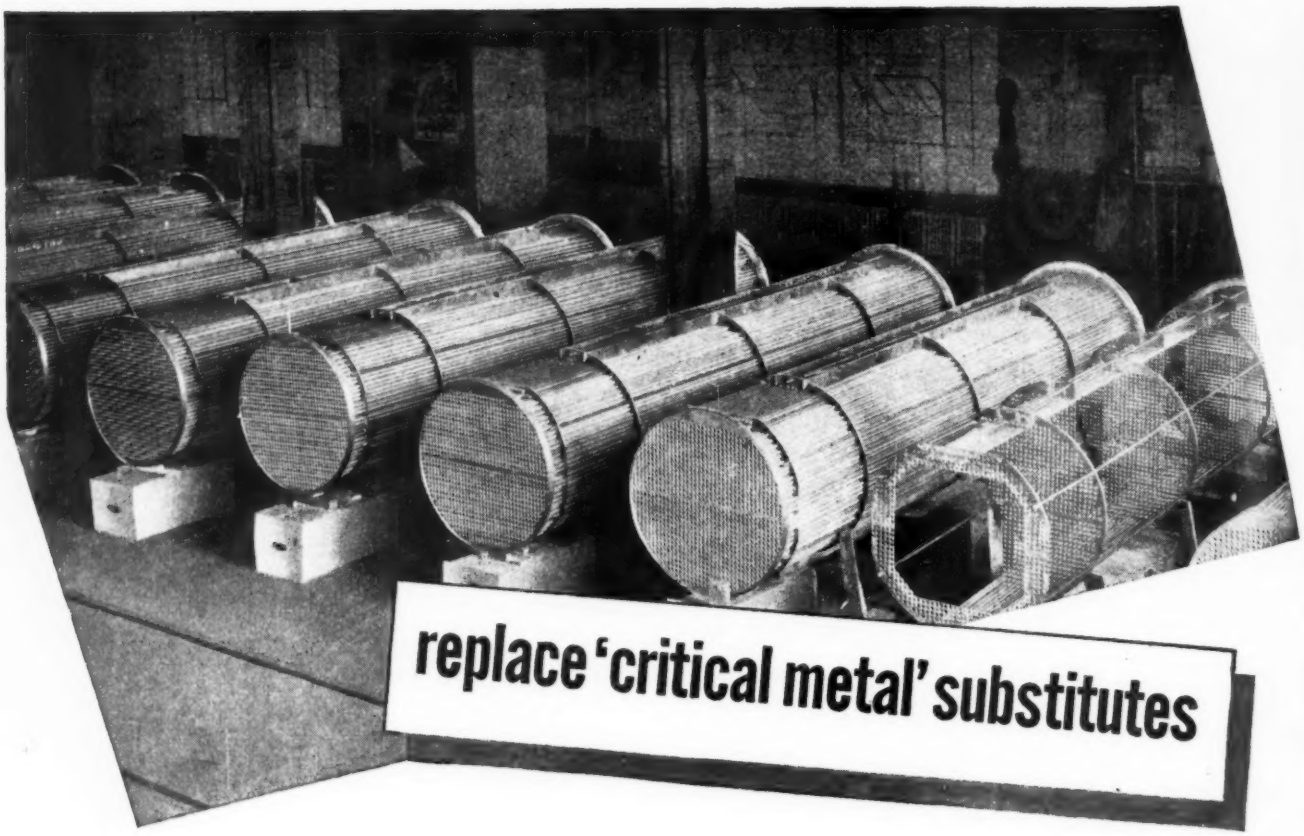
"TUBE-UP" for full efficiency



Lummus heat exchangers — purchased for war emergency power plant and central station use during critical metal shortages — should now be reviewed for full heat transfer efficiency. In many instances tube bundles of substitute materials may now be replaced with bundles fabricated of metals that will increase operating performance. Furthermore, now is the opportune time to install additional heat exchangers which were necessarily omitted from plant design due to wartime restrictions.

Lummus engineering service is available for making such a review and for the study of specific metal replacement problems and the modernization of power plants to meet post war requirements. For further information write to:

LUMMUS POWER PLANT EQUIPMENT

SURFACE CONDENSERS
•
STEAM JET AIR EJECTORS
•
BLEEDER HEATERS
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BOILER BLOWDOWN HEAT EXCHANGERS
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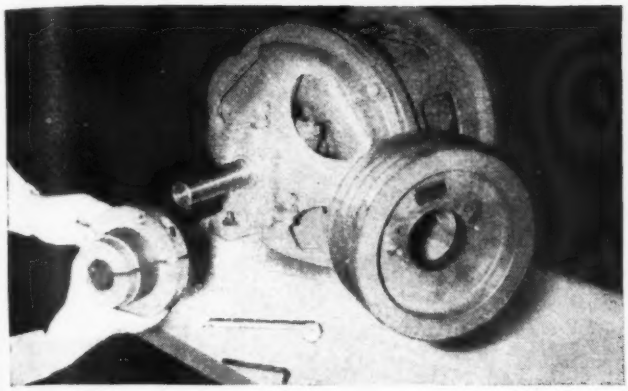
LUMMUS

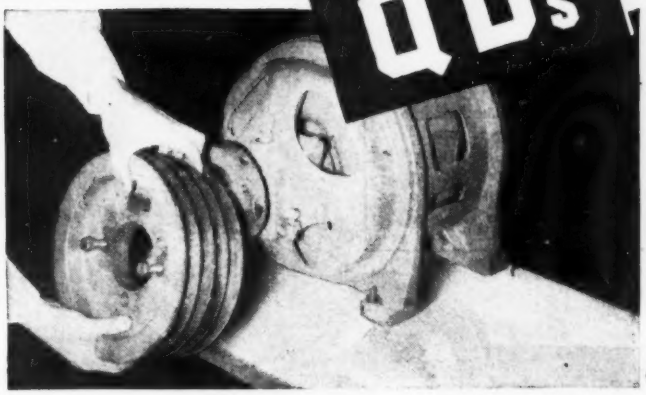
HEAT EXCHANGERS

DO YOU HAVE THESE 3 FEATURES IN YOUR PRESENT SHEAVES?

If so, they must be WORTHINGTON'S QDs



1. EASY TO GET ON



2. EASY TO GET OFF

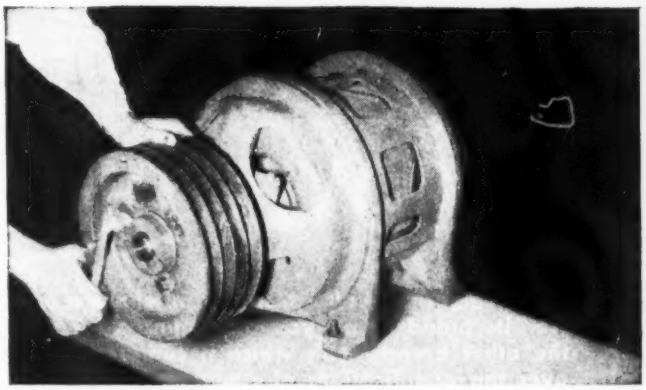
Are you losing time with old-fashioned sheaves? You may be, if you haven't got the QD's time-saving *three* features.

1. Split hub — with taper cone surface for mounting taper bored rim — makes *installation easy*.

2. Pull-up screws usable as jack bolts break Taper Friction Fit, quickly free shaft for bearing maintenance, speed changes, or *quick removal* and mounting of different diameter rims . . . without disturbing the hub. No alignment problems.

3. Bigger pull-up bolts for higher taper cone pressure insure positive clamp grip, keep sheave *always tight on the shaft*.

The sheave with these 3 features, teamed up with Worthington Goodyear Endless Cord V-Belts will give you more for your money. Stock size sheaves and belts at strategic centers from coast to coast.



3. YET ALWAYS TIGHT ON THE SHAFT

Reading Time: 3 Minutes—To Get Accurate Belt Ratings

From the 72-page Master Manual, containing original engineering data . . . sectionalized, loose-leaf, tabbed for ready reference . . . you can select in three minutes the right Worthington V-Belt drive. You get accurate belt ratings . . . avoiding *over*-belting and *under*-belting. Send the coupon today for your free copy! Specification and installation record sheets included.

Centrifugal, Rotary, Steam & Power Pumps | Vertical & Horizontal Compressors | Liquid Meters | Variable Speed Drives | Multi-V-Drives

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Union Finished Steel Roller Chain is manufactured in all standard sizes from ⅜" to 2½" pitch, in single and multiple strands.

LOOK OVER THE BALLOT, THEN VOTE

☆ Every time you specify or purchase a quantity of chain by its brand name, you are voting your preference for it over the other brands with which it competes. Just as you ponder over the qualifications of every candidate for the political office to which he aspires, consider the plus values which Union Chain can bring to the jobs of power transmission and materials handling in your plant or as an integral part of the product which you manufacture.

Union's aim is to win your vote for your chain requirements and to hold your support by seeing to it that you get the proper chain for every application, that you are informed how to install it properly and that you are informed how to lubricate it efficiently in order that you may receive the longest service possible. This is Union's bid for your vote.

The Union Chain and Manufacturing Company . . . Sandusky, Ohio, U. S. A.

Union Catalog A-2 covers Drive and Conveying Chains. Catalog B-2 covers Finished Steel Roller Chain and Sprockets. Ask for your copies.

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Union Chains for Every Application

Drive and Conveying Chains and Sprockets

- Bridge Chain
- Combination Malleable Iron and Steel Chain
- HB (hardened bearing) type chain
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Finished Steel Roller Chains and Sprockets

- All manufacturer's standard sizes ⅜ in. to 2½ in. pitch
- Single and Multiple Strands
- Extended Pitch Series in sizes 1¼ in. to 4 in. pitch

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Silent Chain and Sprockets

- All sizes ⅜ in. to 1½ in. pitch

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Flexible Couplings

- Roller chain type
- Silent chain type

THIS IS IT

COMFORT CONTROL

FOR ALL DEPARTMENTS

From executive offices to shop space, temperature requirements vary widely. That is why Johnson Comfort Control . . . with a thermostat in each department . . . means *real* comfort that promotes good health and increases efficiency. Set the thermostat in each department at the desired temperature and that temperature will be maintained despite wind, direct sunshine and other weather conditions which often upset the "averaging" effect of a centrally located thermostat.

When comfortable working conditions prevail there is less loss of time due to colds and fatigue. Fuel is conserved, too, for there is no waste in overheating some rooms or departments. Comfort Control, pioneered by Johnson nearly 60 years ago . . . and with the numerous refinements made by Johnson engineers through the years since then . . . meets many of today's modern comfort requirements more effectively than any other type of temperature regulation.

Johnson Comfort Control is adaptable to all types of buildings. If you would like to know more about its specific application to a particular modernization or new construction project, get in touch with the Johnson office nearest you. Direct branches are in all principal cities.

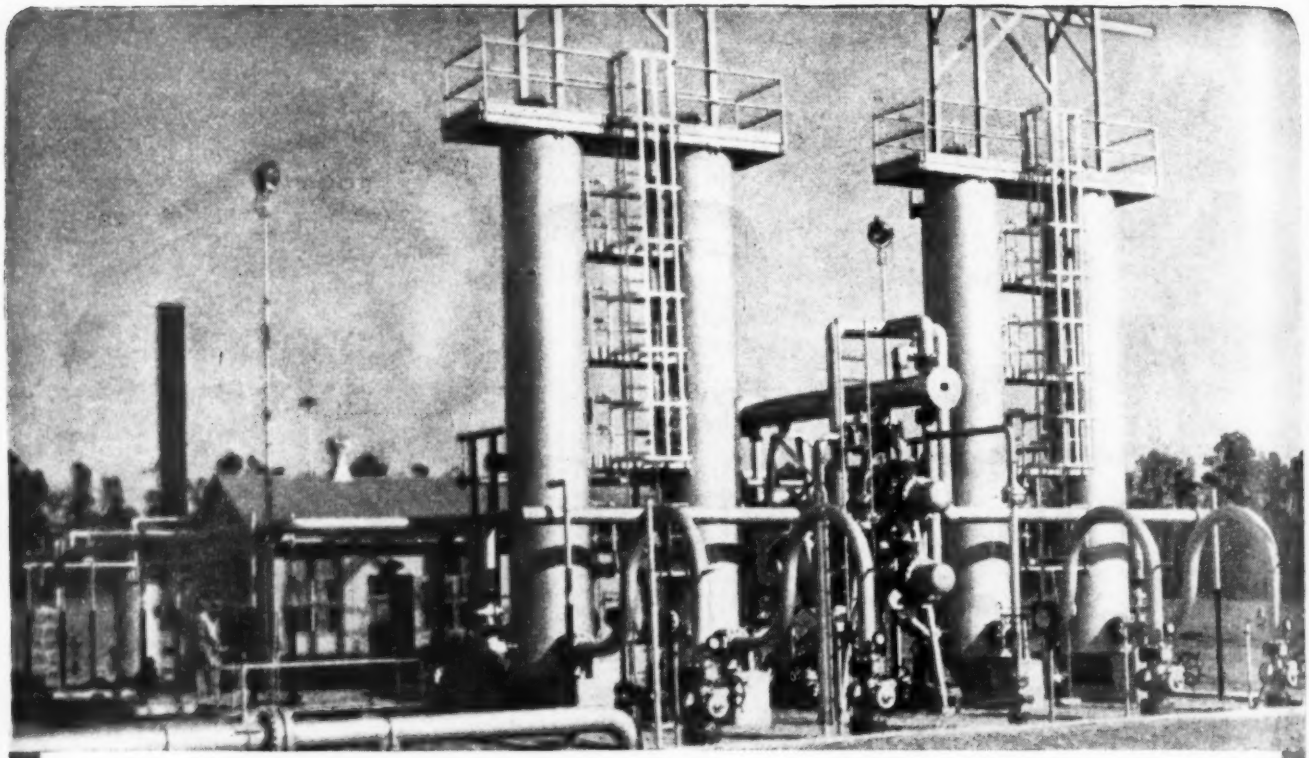
FOR VICTORY SOONER
BUY MORE BONDS

JOHNSON

Fuel Saving Starts With CONTROL

Automatic TEMPERATURE AND AIR CONDITIONING Control

JOHNSON SERVICE COMPANY, MILWAUKEE 2, WISCONSIN • DIRECT BRANCHES IN ALL PRINCIPAL CITIES



EQUIPMENT TO CONTROL AND PROCESS NATURAL GAS DESIGNED, ENGINEERED and CONSTRUCTED

Having engineered through to completion and operation a number of the natural gas industry's handling and treating projects, J. F. Pritchard and Company, through its *Natural Gas Division*, is competently prepared to cooperate with you in your particular problems. The experience and knowledge of Pritchard engineers assures you of obtaining the proper equipment for the job to be done.

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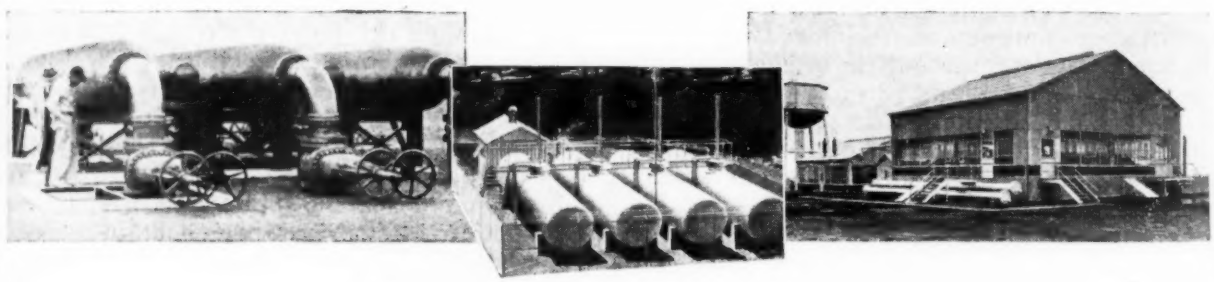
J. F. Pritchard and Company, *Natural Gas Division*, Fidelity Building, Kansas City 6, Missouri



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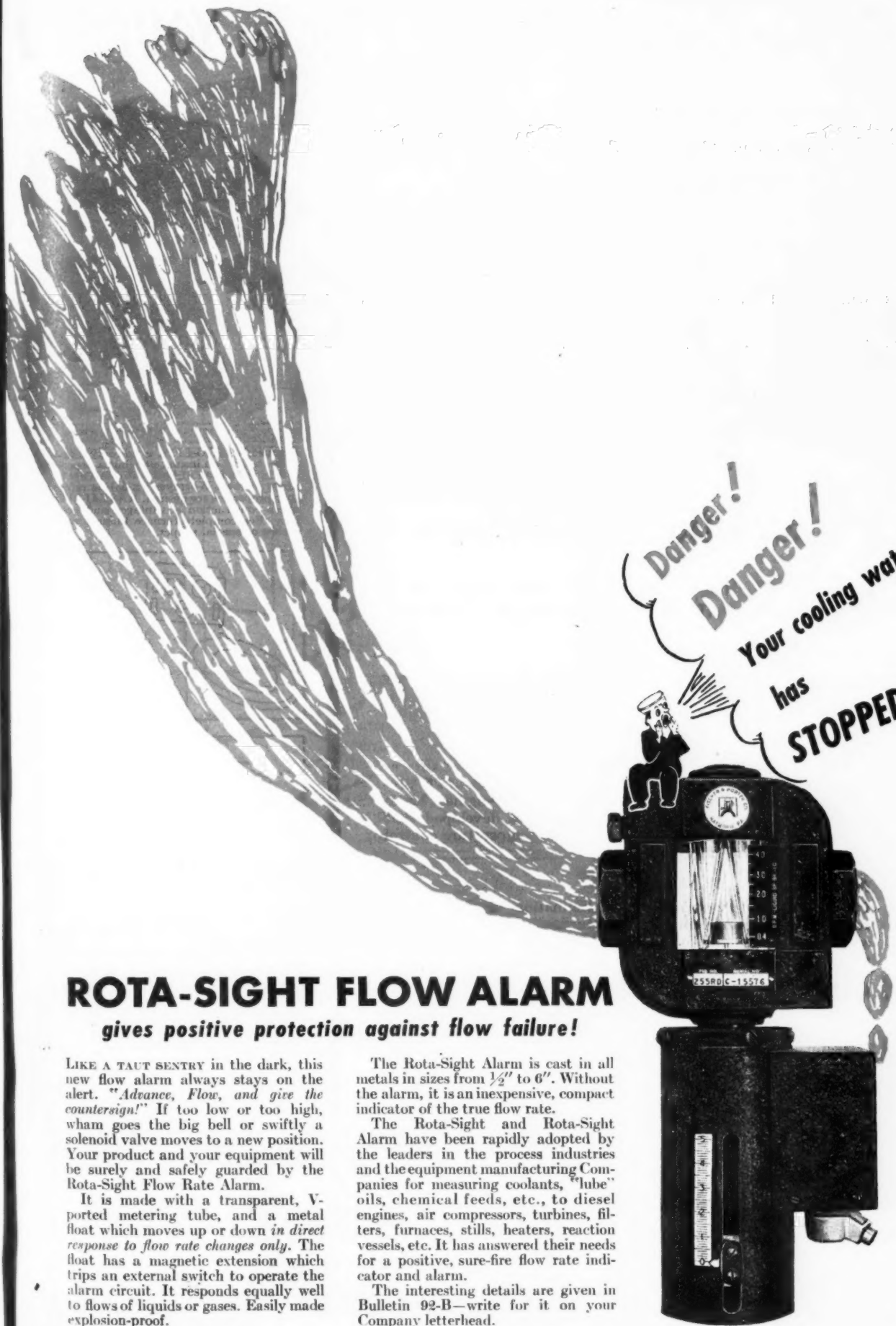


ROTA-SIGHT FLOW ALARM

gives positive protection against flow failure!

LIKE A TAUT SENTRY in the dark, this new flow alarm always stays on the alert. "*Advance, Flow, and give the countersign!*" If too low or too high, wham goes the big bell or swiftly a solenoid valve moves to a new position. Your product and your equipment will be surely and safely guarded by the Rota-Sight Flow Rate Alarm.

It is made with a transparent, V-ported metering tube, and a metal float which moves up or down *in direct response to flow rate changes only.* The float has a magnetic extension which trips an external switch to operate the alarm circuit. It responds equally well to flows of liquids or gases. Easily made explosion-proof.

The Rota-Sight Alarm is cast in all metals in sizes from ½" to 6". Without the alarm, it is an inexpensive, compact indicator of the true flow rate.

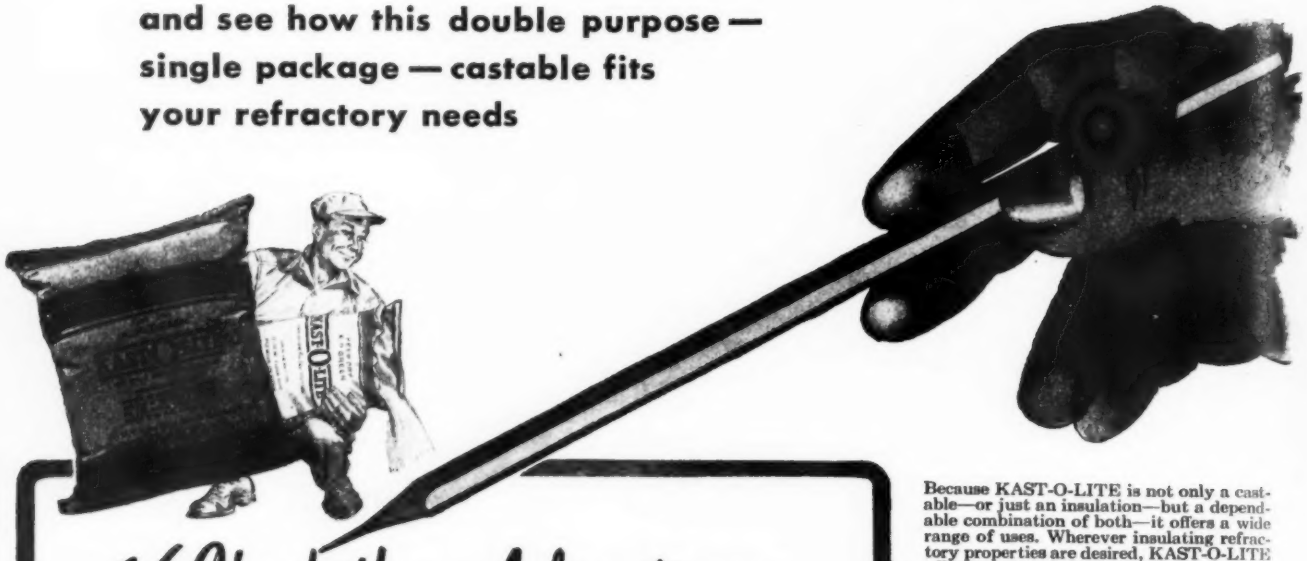
The Rota-Sight and Rota-Sight Alarm have been rapidly adopted by the leaders in the process industries and the equipment manufacturing Companies for measuring coolants, "lube" oils, chemical feeds, etc., to diesel engines, air compressors, turbines, filters, furnaces, stills, heaters, reaction vessels, etc. It has answered their needs for a positive, sure-fire flow rate indicator and alarm.

The interesting details are given in Bulletin 92-B—write for it on your Company letterhead.

FISCHER & PORTER CO. 6010 County Line Road HATBORO, PA.

Make this Castable Refractory Test for YOURSELF

and see how this double purpose — single package — castable fits your refractory needs



✓ Check these Advantages

FOUND ONLY IN KAST-O-LITE, THE MOST AMAZING REFRACTORY MATERIAL IN ENGINEERING HISTORY

1. *Cuts Heat Losses*

The thermal conductivity of KAST-O-LITE as used is only approximately 30% that of heavy firebrick. This means that 9" of KAST-O-LITE (the normal thickness of a furnace lining) is equal to 27" of firebrick in insulating value.

2. *Heat Storage is Reduced*

Because of its low heat storage capacity, KAST-O-LITE produces a higher wall surface temperature. By reducing heat losses and heat storage, radiant heat properties are developed that shorten heating and cooling periods. Closer temperature control is possible. Fuel savings result.

3. *Monolithic*

Operating economy results from elimination of joints. This reduces air-infiltration and increases furnace efficiency. Smooth-surfaced, jointless walls or linings of KAST-O-LITE offer less resistance to the flow of gases with consequent reduction of erosion.

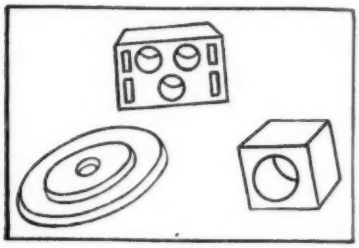
4. *High Heat Resistance*

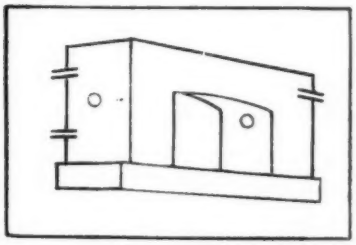
The basic ingredient of KAST-O-LITE is high quality fireclay. It has high resistance to heat and, like no other insulating castable refractory, may be used in direct contact with flame up to 2500° F.

5. *Easy to Use*

KAST-O-LITE, as its name implies, may be cast using simple formwork in much the same manner as structural concrete. Mix with water and use.

Because KAST-O-LITE is not only a castable—or just an insulation—but a dependable combination of both—it offers a wide range of uses. Wherever insulating refractory properties are desired, KAST-O-LITE offers construction advantages and economy. For complete furnace linings, walls, arches or special shapes.





FREE Data Book

This big 24-page factual book, just off the press, tells you just what KAST-O-LITE is, where it produces savings and why it's the world's most amazing castable refractory. Write for your free copy today.

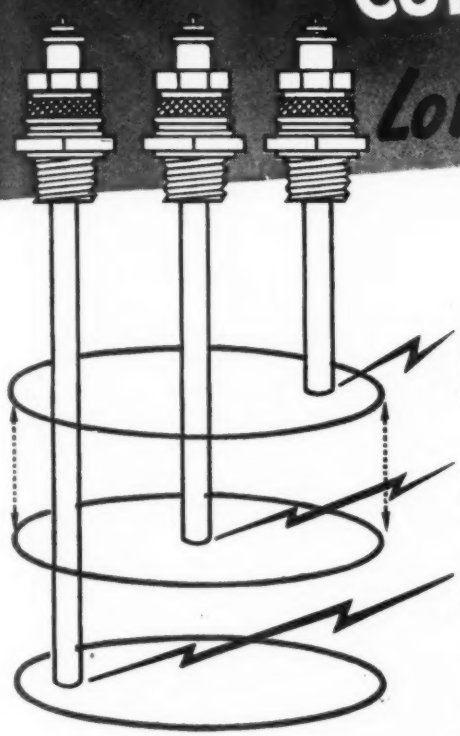
KAST-O-LITE
INSULATING CASTABLE REFRACTORY

A. P. GREEN FIREBRICK COMPANY

A.P. GREEN — *the First Name in Refractories*

MEXICO, MISSOURI

NOW -- Completely Automatic Boiler Feedwater Control at Low Cost



At normal high-water level, Fireye shuts off boiler feedwater pump.

At normal low-water level, Fireye starts feedwater pump.

At danger level, Fireye cuts off fuel and sounds alarm.

. . . with fireye the modern electronic system

The Fireye method of boiler feedwater regulation is floatless, maintenance-free—*electronic*—the modern word for "the best in automatic control." Completely eliminated are troublesome mechanical devices subject always to wear and maintenance—failure and replacement.

Metal probes—electronic fingers—"feel" levels as rising or falling water makes and breaks probe-tip contact, relaying to Fireye a minute electrical current. Amplified within the electronic control, this current actuates heavy-duty switches to start and stop the feedwater pump as required and to provide instantaneous alarm at a low-water danger point.

Write today for full details on how Fireye Electronic Control can be applied to your boilers. Ask for Catalog 51.

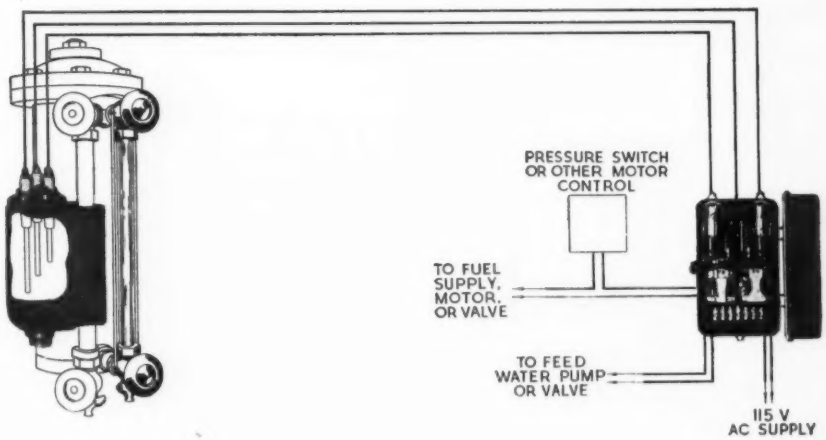
★ ★ ★

FIREYE PHOTOELECTRIC FLAME FAILURE SAFEGUARD eliminates explosion hazards in oil or pulverized coal burners. Write for Catalog 50.

OPERATION

Fireye Probe Fitting—mounted parallel to the water column and wired to Fireye Electronic Control—incorporates three probes marking boiler feedwater pump on and off levels and a low water danger point.

When water falls below the middle probe, Fireye closes the pump control circuit and water is automatically fed to the boiler until the level reaches the top probe. Fireye then opens the circuit, stopping the pump until the water again drops below the middle probe. Should the level at any time fall below the lowest, or safety probe, Fireye instantly cuts off the fuel supply and sounds an alarm.



COMBUSTION CONTROL CORPORATION

Cambridge 42, Mass. • District Offices in all Principal Cities

fireye **electronic**

BOILER FEEDWATER CONTROL

IN DESUPERHEATING SERVICE . . .

"THIS PUMP HOLDS TEMPERATURES WITHIN ±1° F."

UNDER FULLY AUTOMATIC CONTROL

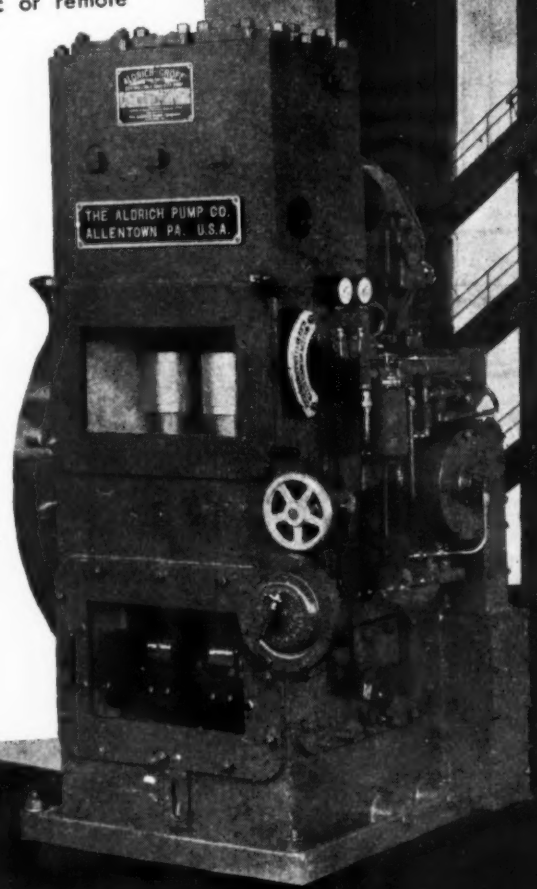
In an eastern public utility station, an Aldrich-Groff controllable capacity "Powr-Savr" Pump has been in almost continuous operation for nearly three years, supplying water for desuperheating steam. Arranged for automatic temperature control, its response is such that "the indicating and recording instruments show a total variation of only 1° F. from the desired temperature". This pump has a variable capacity from 0 to 65 GPM at a constant pump speed of 190 RPM against 350 lbs. pressure and is driven by a 20 HP 1750 RPM constant speed A.C. motor.

Aldrich-Groff Pumps provide for automatic or remote manual control of delivery from zero to full rated capacity at constant pump speed. Rate of delivery is controlled by variation of the length of plunger stroke and power consumption is almost directly proportional to pump delivery. They offer the advantages of feed system simplicity, efficiency and mechanical reliability of the small and medium boiler plant using medium or high steam pressures, and for desuperheater feed service in even the largest power stations.

Write for bulletins and material giving full details, sizes and ratings of Aldrich-Groff Pumps.

THE ALDRICH PUMP COMPANY

ALLENTOWN · PENNA.



THE ALDRICH-GROFF CONTROLLABLE CAPACITY "POWR-SAVR" PUMP

TRADE MARK

Now We Get

Comfortable Heat Every Day

"I used to call Monday my 'complaint day'... No heat on the top floor ... Too much heat on the ground floor ... Did I think the building would *ever* heat up? ...

"But now we have a new system—the Webster Moderator System of Steam Heating. We get all the heat we need, automatically ... And I don't even worry about fuel rationing!"

The Webster Moderator System of Steam Heating assures prompt heating-up, balanced distribution of steam and even room temperature throughout the building. Waste of valuable fuel through overheating is minimized.

More Heat with Less Fuel

Webster Engineers have found through surveys of thousands of buildings that seven out of ten buildings in America (many less than ten years old) can get up to 33 per cent more heat from the fuel consumed.

If you are interested in an economical, trouble-free heating system, write for our free booklet, "Performance Facts." It contains 268 case studies of modern steam heating installations and the great savings they are effecting.

ADDRESS DEPT. P-10.

WARREN WEBSTER & COMPANY, Camden, N. J.
Pioneers of the Vacuum System of Steam Heating :: Est. 1888
Representatives in principal cities :: Darling Bros., Ltd., Montreal, Canada

Shown at left is the small Control Cabinet of a Webster EH-10 Moderator System, central heat control of the pulsating flow type. It can be used to automatically operate a motorized valve in steam mains, or directly control burner or stoker of your boiler. This Moderator System is used chiefly for the small and medium size building. For the larger building, Webster Type E-4 Moderator System is generally recommended. Full details of these Webster Systems on request.

Fuel-Saving Starts With CONTROL

Webster Steam Heating

HOW TO KEEP 15,000 TRUCKS ON THE GO

These Elastic Stop Nuts are holding the driving flange. Even with frequent starts and stops, and the steady use the wheels of an express truck get, these nuts hold fast.

Railway Express truck bodies are completely fastened with Elastic Stop Nuts. Where other fastenings give with the sway and twist of the truck, these nuts hold tight.

Throughout the chassis, Elastic Stop Nuts are used wherever ordinary nuts loosen in service. Here they are fastening the hand-brake drum on the propeller shaft.

ON the road, trucks earn their keep. In the shop they eat their heads off.

The Railway Express Agency knows that well. And they learned one of the answers to keeping trucks on the go way back in 1927.

They use Elastic Stop Nuts — use them on a great many of their 15,000 trucks.

The reasons? These nuts increase safety and cut down mishaps. They reduce maintenance time and upkeep costs.

Elastic Stop Nuts go on like ordinary nuts. They need no auxiliary locking devices. They can be taken off and put back on time and time again and still lock. Nothing — even severe vibration — shakes them loose.

It's the elastic collar in the top that does the trick. It hugs the bolt threads tight. It cushions vibration. The nut can't shiver loose and turn.

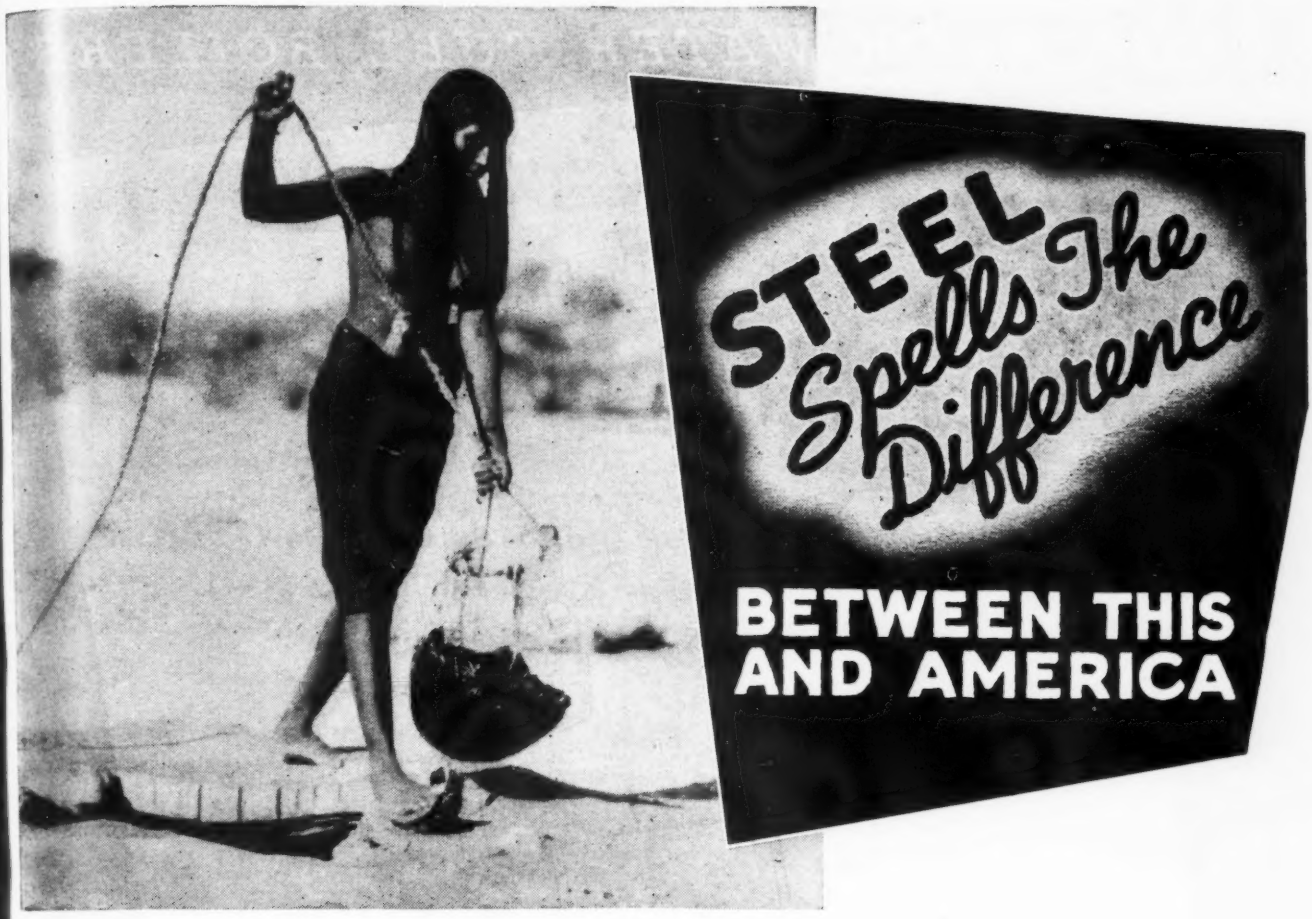
Today billions of these nuts with the ESNA red collar are being used on our aircraft. A bomber takes as many as 50,000 in a single ship.

In the days to come there will be countless fastening problems on all kinds of products. Perhaps you have one now.

If so, we'd like to talk about it. Our engineers are at your service ready to recommend the right Elastic Stop Nut to provide a safer, surer, trouble-free fastening.

Major spots where Elastic Stop Nuts are at work on Railway Express Agency Trucks

Steering post — fasten bracket to cowl • Steering post — hold bracket to chassis • Drive shaft and universals • Master-brake cylinder to bracket • Hand-brake drum to shaft • Gas tank straps • Propeller shaft center carrier • Clutch and brake pedal brackets • Rear wheel hubs • Motor supports on cross member • Shackle bolt lock pin • Front bumper brackets • Cab bolts • Body hinges • Truck bodies — approximately 375 nuts.



THIS Arabian girl is drawing water from a well in the Sahara desert--just as her ancestors did five thousand years ago. Like millions of other women in foreign lands today, she is sentenced to a lifetime of hard labor through lack of steel and time-saving equipment built from steel, which makes American civilization what it is.

Most of us whose homes, offices and workshops are piped with hot and cold water never think of scenes like this. Yet in many other countries such primitive conditions still exist, and water for drinking, cooking, bathing, washing clothes, cultivating crops, and in fact for all purposes, has to be raised and carried by human hands.

In America, steel piping brings us life-sustaining supplies day or night. It carries liquids, gases, even many granular solid materials, at minimum cost in money or human effort.

For nearly half a century, architects, engineers and contractors have been specifying and installing Youngstown steel pipe for water lines and other such vital piping as heating and plumbing systems, and oil and gas pipe lines.

To look ahead, low-cost, durable Youngstown pipe, can bring comfort, convenience, sanitation and all around better living conditions to all the peoples of the world.

YOUNGSTOWN

THE YOUNGSTOWN SHEET AND TUBE COMPANY

YOUNGSTOWN, OHIO

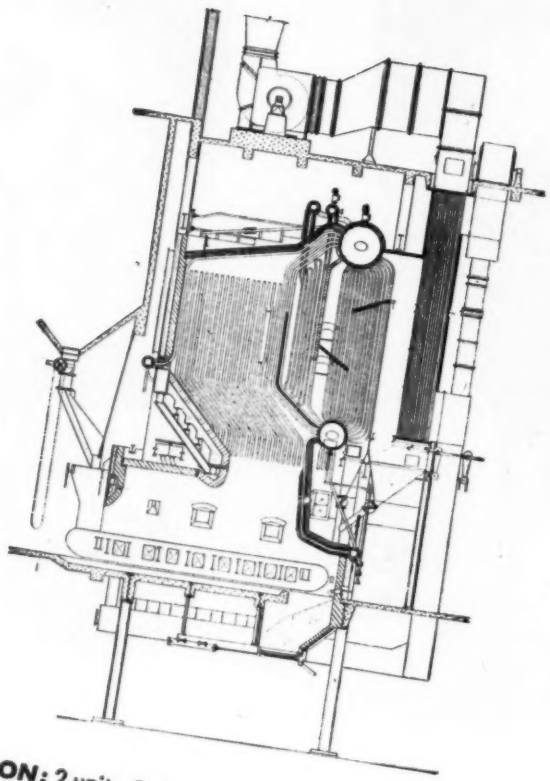
Manufacturers of

Carbon, Alloy and Yoloy Steels

QUALITY YOUNGSTOWN SERVICE

Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Electrolytic Tin Plate - Coke Tin Plate - Rods - Wire - Nails - Tie Plates and Spikes - Alloy and Yoloy Steels.

EDGE MOOR WATER TUBE BOILERS



THIS INSTALLATION: 2 units; 2-drum, bent tube, with superheater, water walls, vertical tubular air preheater.

CAPACITY	75,000 lbs. steam per hour
DRUM PRESSURE	450 psi.
DEGREES OF SUPERHEAT	300
FINAL STEAM TEMPERATURE	750° F.

These boilers are equipped with chain grate stokers and Edge Moor vertical tubular air preheaters for the efficient burning of lighite fuel.

- Edge Moor Boilers are designed for any required capacity and up to 900 lbs. drum pressure. Complete steam generating units are available, including boilers, superheaters, water walls, economizers and air preheaters.

STEAM GENERATING EQUIPMENT

EDGE MOOR
IRON WORKS, INC.

BRANCH OFFICES: NEW YORK 20, N. Y.: 30 ROCKEFELLER PLAZA
CHICAGO 2, ILL.: ONE NORTH LA SALLE STREET

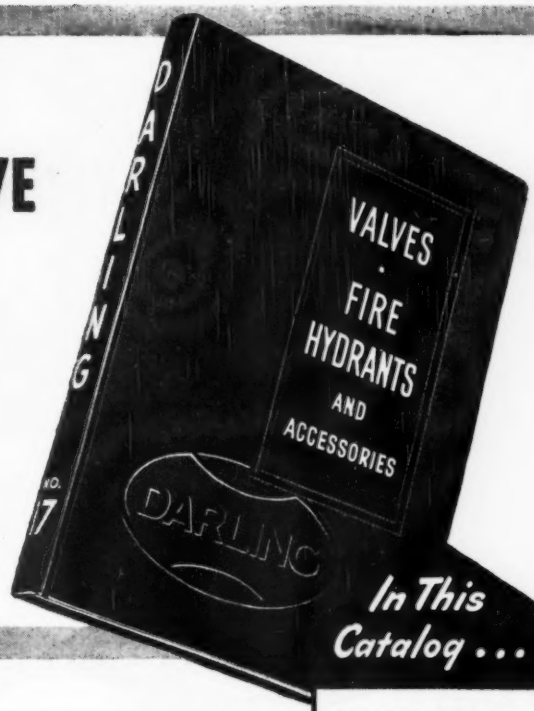
MAIN OFFICE: EDGE MOOR, DELAWARE

Now Ready!

THE NEW DARLING VALVE CATALOG FOR ALL INDUSTRIES

with

Complete Up-To-The-Minute General Data and Specifications for use in your Plant Design, Construction, and Maintenance



THIS new Darling Valve Catalog is actually *more* than a catalog—it's a handbook of informative data and valuable information which you will have occasion to use, time and time again. Compiled and edited only after years of research and practical experience, this book will prove most valuable in the purchase and maintenance of valves in your plant.

You can know in advance what valve designs and materials will best fit your needs for various services. You can know why certain mechanical features make valves last longer—operate easier—give positive shutoff—cost less to maintain. You can also know why so many industries, for so many years, have insisted upon Darling Valves for critical plant installations.

In This Catalog . . .

Over 500 photographs, sectional views, designs, detailed drawings and other highly interesting illustrations are shown

•

Over 300 pages of descriptive data and specifications are indexed and cross-indexed for ready reference.

•

More than three years of time and energy have been expended in the creation and completion of this material

•

Technical contributions include the finest valve engineering talent available

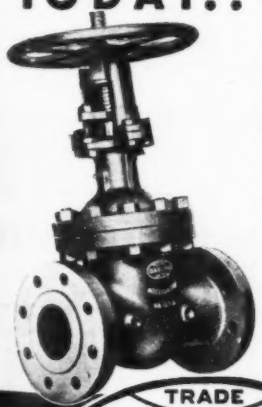
•

A total of more than 125 working days went into one single phase—that of proof reading.

•

Each book is registered and recorded in the name of the recipient and his company

SEND FOR YOUR COPY TODAY. .



It's ready now! Your copy of the new Darling Catalog can be shipped immediately. Simply fill in the coupon and mail to Darling Valve & Manufacturing Co., Williamsport, Pa. There is no obligation.

Darling Valve & Manufacturing Co.
Dept. E, Williamsport, Pa.

Please send me copy of your new catalog. I am particularly interested in:

- ☐ Corrosion Resistant Valves
- ☐ Cast Steel Valves
- ☐ Special Alloy Valves
- ☐ Check Valves
- ☐ Bronze Valves
- ☐ Fire Hydrants
- ☐ Forged Steel Valves
- ☐ Marine Valves
- ☐ Composition Cups

Name _____ Title _____

Company _____

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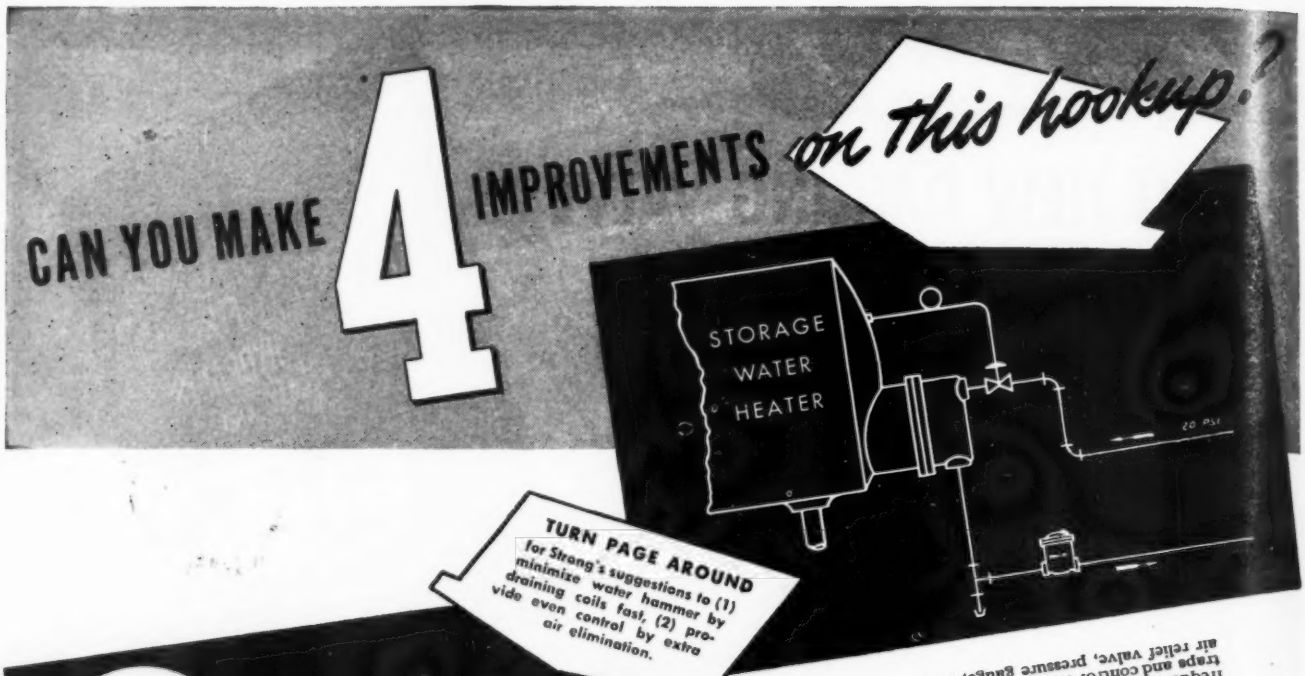
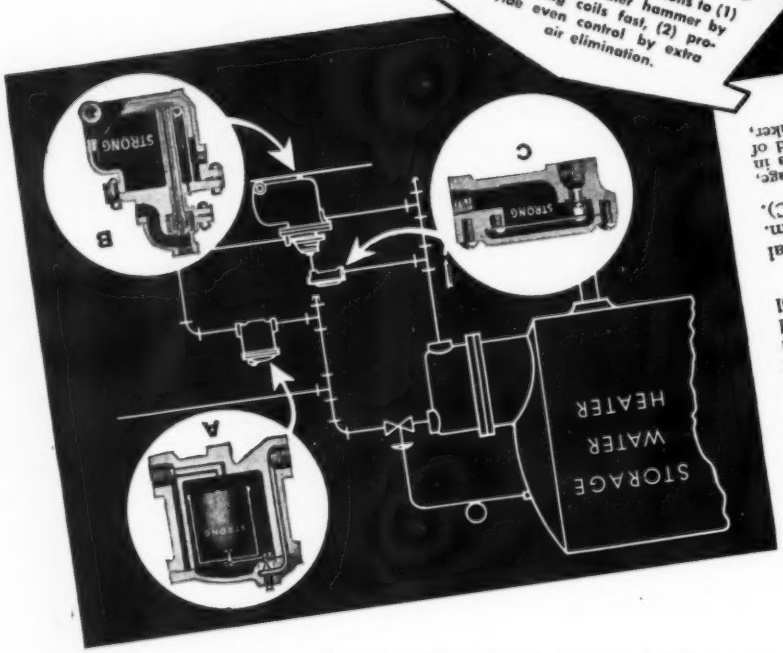
TRADE DARLING MARK

VALVE & MANUFACTURING CO.
WILLIAMSPORT, PA.

CAN YOU MAKE 4 IMPROVEMENTS on this hookup?



TURN PAGE AROUND for Strong's suggestions to (1) minimize water hammer by draining coils fast, (2) provide even control by extra air elimination.



1. Drain steam supply line to avoid water pocket when throttling valve is closed. Suggest small Strong inverted bucket trap (A).
2. Open bucket traps give positive action at the low pressures resulting from the throttling action of control valve.
3. Inverted type in upper hook-up too small to remove accumulated condensate quickly, resulting in dangerous "hammer". Use Strong trap (open or inverted) with capacity 4 to 8 times normal condensing rate to drain coils fast when control valve opens suddenly (B).
4. Air by-pass speeds up air and condensate removal whenever control valve opens the flow of steam. Use Strong thermal air valve across the trap (C).

Note: While the suggested hook-up provides adequate drainage, there are several equally good piping arrangements in frequent use. Piping should include strainers (ahead of traps and control valve), unions, by-pass, vacuum breaker, air relief valve, pressure gauge, etc.

NOT JUST *KNOW-HOW,* BUT *WHAT WITH*

Draining this storage water heater is a case in point. Either Strong inverted or open bucket type traps are commonly used, but open bucket traps have proved most suitable for heaters using low-pressure steam, especially if throttling type regulator is installed. On medium or high pressures, either inverted or open bucket type may be used.

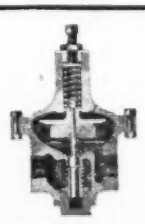
Knowing drainage facts like these and working with the most complete line of steam specialties, Strong engineers can recommend exactly the type and size you need. Strong traps are made with open or inverted buckets, closed float, float-and-thermostatic (blast), forged, fabricated (welded), cast and semi-steel. Anum-Metal valves and seats are guaranteed leak-proof for a year.

SEND IN YOUR DRAINAGE PROBLEMS. We'll be glad to suggest a remedy for your drainage difficulties. A rough sketch of the piping will do, plus data on differential pressures and difficulties encountered.

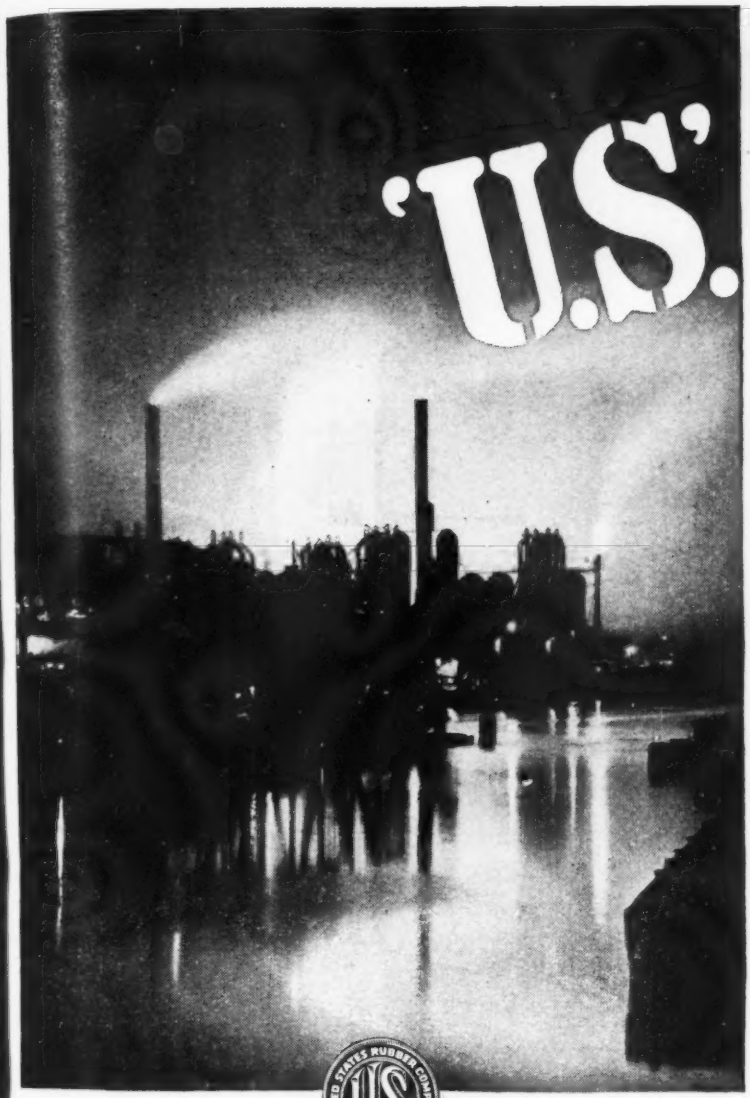
STRONG, CARLISLE & HAMMOND COMPANY
Cleveland 13, Ohio

STRONG
STEAM SPECIALTIES

Welded Steel Traps


Reducing Valves

Float Traps



573

A PACKING FAVORITE IN MODERN INDUSTRY

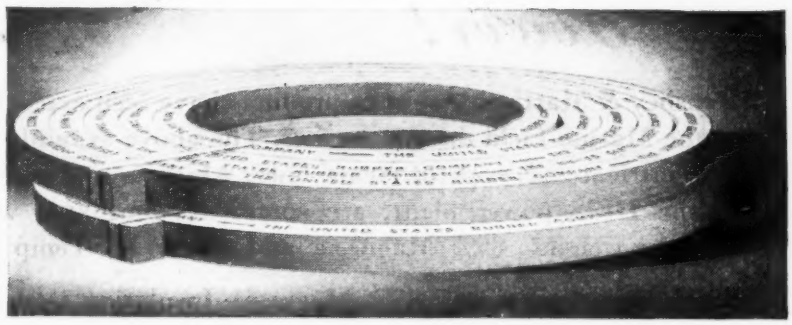
For long and continuous service on inside and outside packed pumps, maintenance engineers say there is nothing better than U. S. 573 Fine Hydraulic Packing.

Laminations of high quality duck—pre-tested for strength requirements are bonded together with a special compound, developed in "U. S." laboratories.

This special compound not only minimizes ply separation, but increases the packing's aging qualities. U. S. 573 is furnished in either regular or rock hard cure, depending on water temperatures encountered.

SERVING THROUGH SCIENCE

FABRIC TESTS—Service qualities of fabrics and other materials used in U. S. Hydraulic Packings are rigidly tested and must meet our strict factory specifications.



SIZES—From ¼ in. up—U. S. 573 Fine Hydraulic Piston Packings are furnished in coils and rings. Rings made with step, skive or butt joints. Orders should indicate which cure is desired—regular or rock hard.

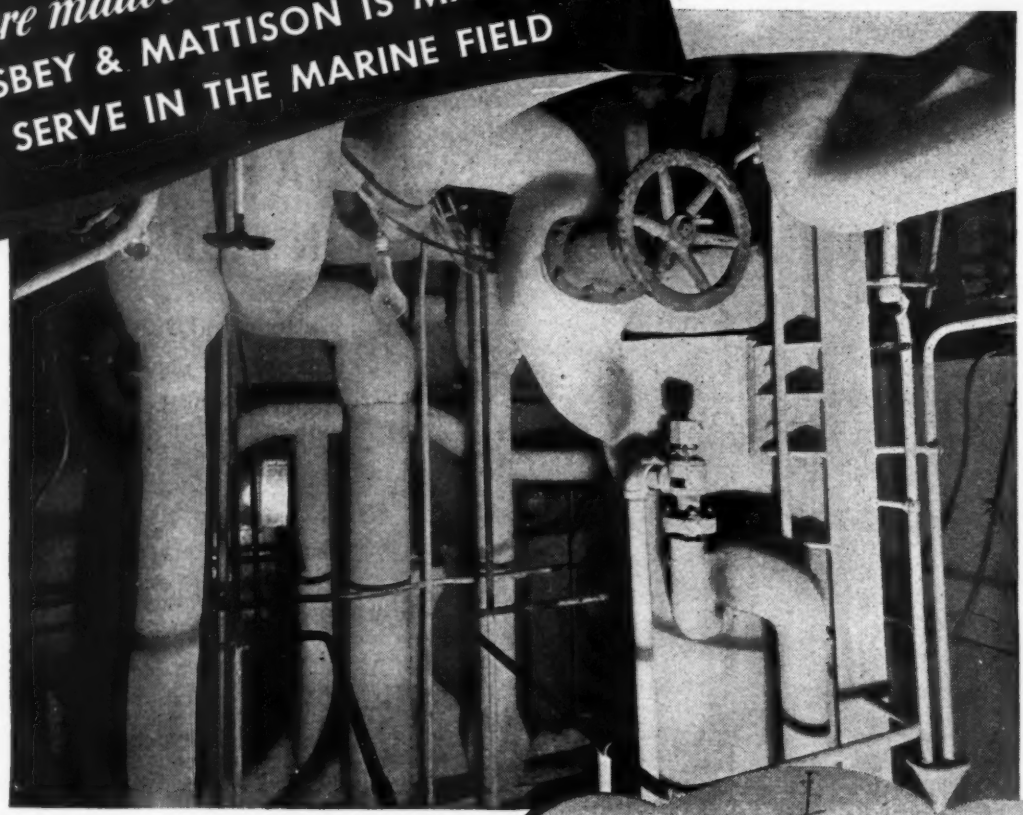
Listen to the Philharmonic-Symphony program over the CBS network Sunday afternoon, 3:00 to 4:30 E.W.T. Carl Van Doren and a guest star present an interlude of historical significance.

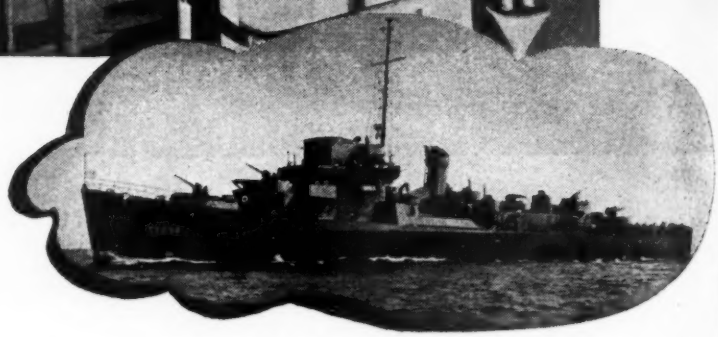
UNITED STATES RUBBER COMPANY

1230 Sixth Avenue • Rockefeller Center • New York 20, N. Y.

Nature made Asbestos HERE IS HOW KEASBEY & MATTISON IS MAKING IT SERVE IN THE MARINE FIELD

USS "Bunch" a Destroyer-Escort Vessel, built by the famous "Defoe Roll-over Process" by the Defoe Shipbuilding Company, Bay City, Michigan. Keasbey & Mattison heat insulations installed by the Armstrong Cork Company.





K&M High Temperature Insulations

Save Steam and Power!

Keasbey & Mattison Asbestos products have seen extensive service in the Marine Field during the war. The above example is typical. The intricate network of steam lines, which are an essential part of the DE'S power plant, are completely insulated with K&M "Featherweight" 85% Magnesia and K&M Hy-Temp Covering.

K&M "Featherweight" 85% Magnesia Insulation is designed for temperatures up to 600°F. — Hy-Temp for temperatures to 1900°F. The proven quality and dependability that these K&M Insulations have shown at sea has also been apparent in every industrial use to which they have been put. In hundreds of plants throughout the country, these insulations are daily saving tremendous quantities of heat, fuel and power.

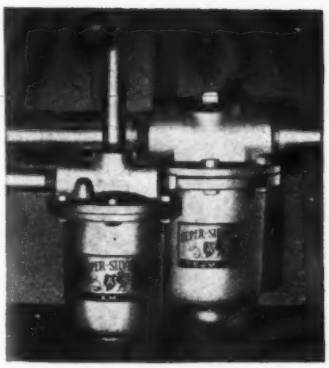
KEASBEY & MATTISON

COMPANY · AMBLER · PENNSYLVANIA

3 years ago
WE PREDICTED—

It's Bound to Come

...OTHERS MUST FOLLOW SUPER-SILVERTOP
Yes, we predict "It's bound to come"—
that other inverted bucket traps must
offered with straight-
because trap
inverted bucket that gives true engi-
neering control to bucket motion.
Also, the le
valve mechanism



Super-Silvertop piped straight-in-line or as an elbow needs but one fitting.

TODAY IT'S COME TRUE

Three years ago we predicted that other inverted bucket steam traps would someday offer the straight-thru piping that originated on all Anderson Silvertops in 1935. Today, that prediction has come true . . . straight-in-line or elbow piping of steam traps has become accepted practise. Buyers know that Super-Silvertop piping saves 6 to 13 fittings and more than an hour's installation time per trap. And they also know that Super-Silvertops provide greater condensate capacity in a case of any size, and that Super-Silvertops can be inspected without removal from the line. Full details of Super-Silvertops are in the book "How to Choose a Steam Trap". A copy is sent free upon request.

THE V. D. ANDERSON COMPANY

1934 WEST 96th STREET • CLEVELAND 2, OHIO

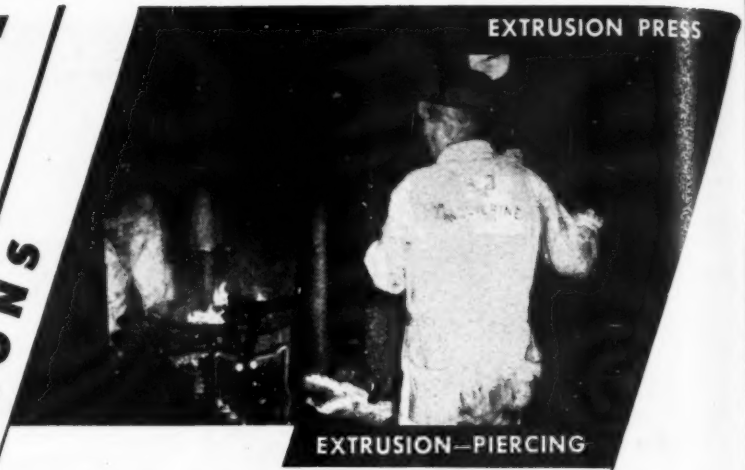
Do You Want to Know

HOW TUBING IS MADE ?

Send for this **FLOW CHART**

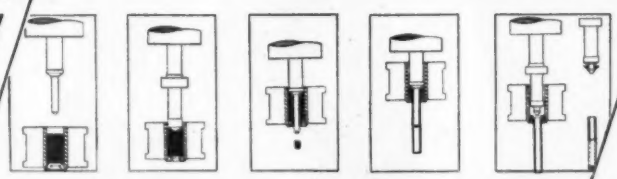
TYPICAL DIAGRAMS AND ILLUSTRATIONS

Tells step by step story of the manufacturing processes of seamless copper and brass tubing. Shown here are a few of the many diagrams and illustrations; printed on heavy paper 32 x 22 inches. Write Detroit for Flow Chart 348.



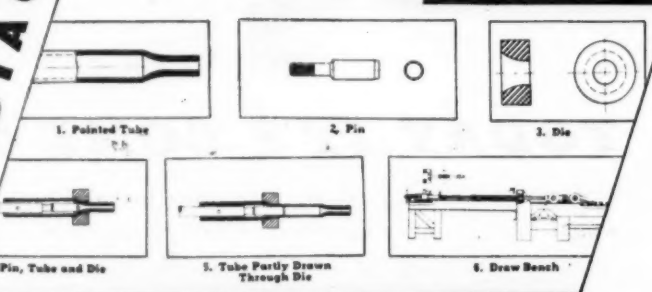
EXTRUSION PRESS

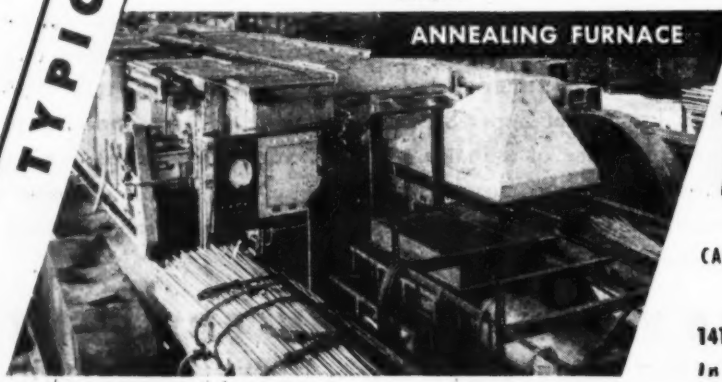
EXTRUSION—PIERCING



DRAW BENCH

DRAWING





ANNEALING FURNACE

BUY WAR BONDS

WOLVERINE

TUBE DIVISION

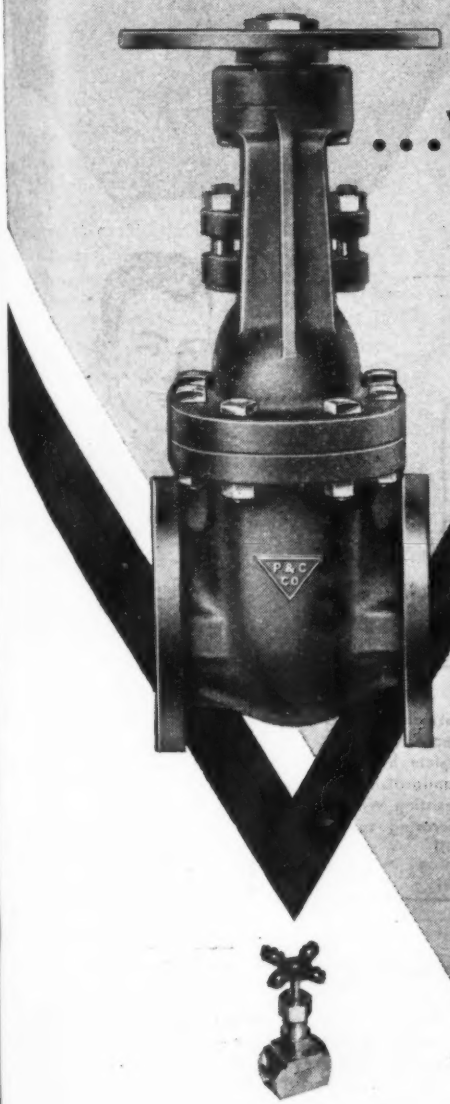
CALUMET & HECLA CONSOLIDATED COPPER COMPANY

1411 CENTRAL AVENUE • DETROIT 9, MICHIGAN

In Canada: UNIFIN TUBE CO., LONDON, ONT.

R P&C CO VALVES

...Veterans of long standing



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PRATT & CADY Brass and Iron Valves since 1878 . . .

D'ESTE Valve and Engineering Specialties since 1870 . . .

. . . veterans all. Yes, and pioneers—in the development of improvements to make valves function better, last longer, serve more efficiently and at lower over-all cost.

Thus, as a manufacturing organization, Reading-Pratt & Cady has long and *specialized* experience in the making of good valves. Moreover, Reading-Pratt & Cady serves you as a single responsible source for your valve requirements.

READING-PRATT & CADY

MANUFACTURERS OF

READING CAST STEEL VALVES AND FITTINGS • PRATT & CADY BRASS AND IRON VALVES
D'ESTE VALVE AND ENGINEERING SPECIALTIES

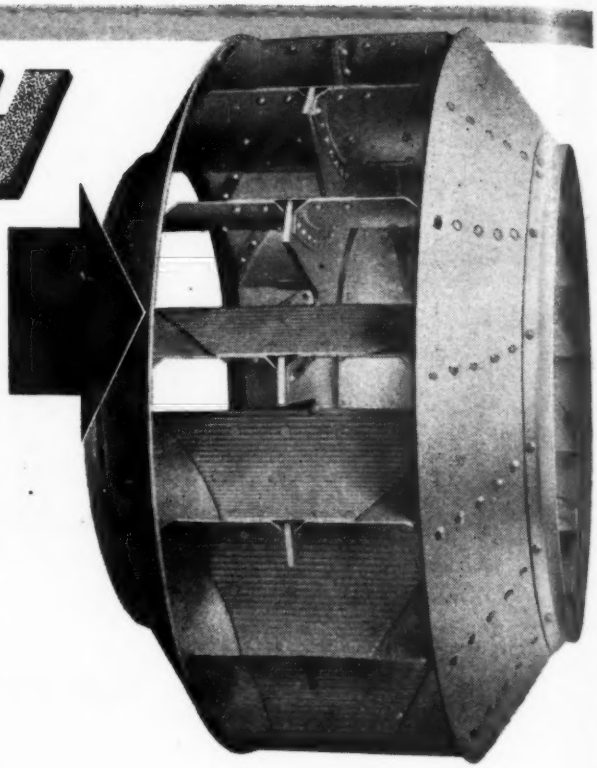
Reading, Pa., Atlanta, Boston, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco

A DIVISION OF AMERICAN CHAIN & CABLE COMPANY, Inc., BRIDGEPORT, CONNECTICUT

FLY-ASH

KNOCKS ITSELF OUT!

When you use this Sturtevant Erosion-Resisting Fan Wheel



"Induced draft fan wheel wears out in six months. The one that replaced it shows no sign of wear after two years." That's the kind of record the Sturtevant Erosion-Resisting Wheel is making in outstanding plants. This is how it is done:

1. Heavy ash concentrations from both inlets *impinge against each other*—dissipating the abrasive action.
2. Continuous blade surface—without a divisional centerplate offers no obstruction to smooth flow of fly-ash.
3. Special ribbed liners protect the blades in the path of the most concentrated fly-ash travel. These liners attached by countersunk rivets can be quickly and easily renewed.

Examine your induced draft wheels—and plan on using the Sturtevant Erosion-Resisting Wheel when replacement is necessary.

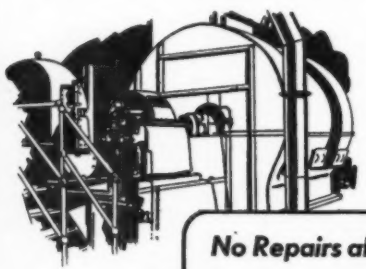
B. F. STURTEVANT COMPANY, Hyde Park, Boston 36, Mass.

CHECK THESE RECORDS IN OUTSTANDING PLANTS

In Operation 3 Years at Twin Branch

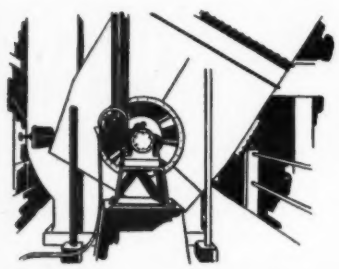
Two induced draft fans serve boilers using 700 tons of coal per day with 9% ash content. Sturtevant Erosion-Resisting Wheels have been in service more than 3 years—show practically no sign of wear—no loss in efficiency!

32 Wheels Ordered for Hudson Ave. Station



Based on the performance of six wheels, in service more than two years, this large system has now ordered 32 more, standardizing on Sturtevant Erosion-Resisting Wheels wherever severe operating conditions are encountered!

No Repairs after 2½ Years in a Large Eastern System

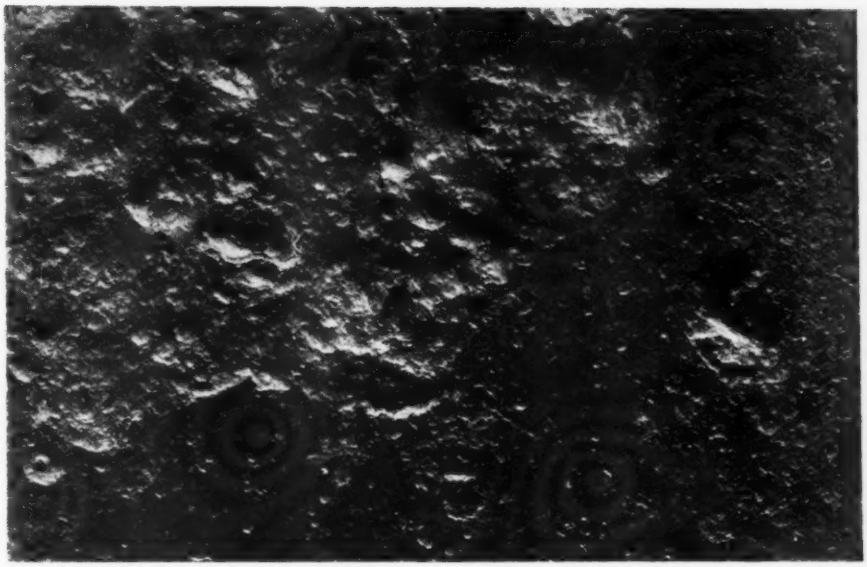


Induced draft fan wheels normally had to be replaced about every year. In the same severe service, a Sturtevant Erosion-Resisting Wheel—recently examined after two and a half years—goes back in service with no repairs necessary! Customer now plans to replace other wheels with Erosion-Resisting Wheels.

Sturtevant *Puts Air to Work*

Fight The Scourge Of Boiler Metal With APEXIOR

APEXIOR provides an impenetrable barrier against corrosion that frequently leads to inefficient operation — costly shutdowns — wasted manpower and horsepower.



Boilers and other equipment exposed to contact with hot water and steam at high temperatures are being effectively protected from premature old age by applications of APEXIOR NUMBER 1. Even some boilers on the inactive list have been returned to service with the help of this thoroughly tested protective coating. In all cases, APEXIOR has extended the period between cleanings and made cleaning much easier and quicker.

APEXIOR—THE PAINT THAT TAKES THE WEAR

APEXIOR NUMBER 1 is a chemically inert "film of safety" for boiler tubes, drums, economizers, and steam turbines. Brush-applied, it fills in the metal pores and joints shutting out water completely. There is less adherent scale, so the problem of scale removal is simplified.

APEXIOR'S tough, smooth surface — not the metal — takes the wear. One application lasts 2 to 3 years or more. It is easily renewed.

Painting boiler metal with APEXIOR is recommended by boiler insurance companies. And many manufacturers of turbines coat shafts, rotor bodies, and frequently interiors of casings with APEXIOR before shipping to customers.

Hundreds of industrial power plants, utilities, railroads, and marine operators have relied on APEXIOR to aid them in fighting the scourge of boiler and turbine metals. It is helping them through this critical period in their history. APEXIOR can do likewise for you . . . prolong the life of your boilers or any equipment having hot wet surfaces . . . conserve manpower and vital materials . . . see you through the war period.

Here are some of the many companies now benefitting by APEXIOR

Hercules Powder Co.
Narragansett Electric Co.
Westinghouse Electric & Mfg. Co.
American Sugar Refining Co.
Tennessee Eastman Corp.
The Pullman Co.
Duke Power Company
Ford Motor Co.
Pittsburgh Plate Glass Co.
Pennsylvania Railroad Co.
General Aniline Works
Standard Oil Co. of Indiana

See how easily APEXIOR can be applied

Write today for Bulletin 1290 (Industrial) or 1305 (Marine) giving complete details on peak protection for peak production.

APEXIOR

A Peacetime Plus ★ ★ ★ A Wartime Must

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

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protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park 36, Mass.

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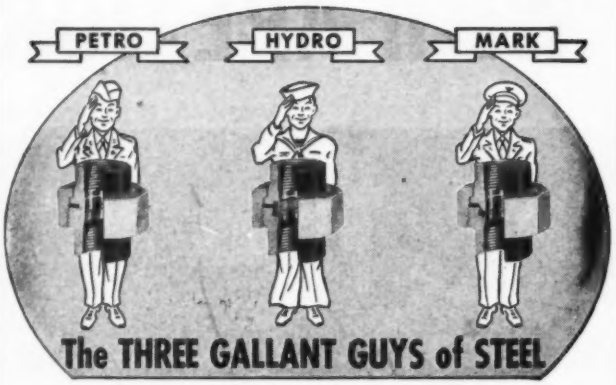
FORGED STEEL UNIONS



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A union of many uses on lines where unions are made up and disconnected frequently.

Use a hammer instead of a wrench to tighten or loosen the nut.

Furnished steel to steel seats, or bronze to bronze seats, black ends and udylited nut, or all rust-proof

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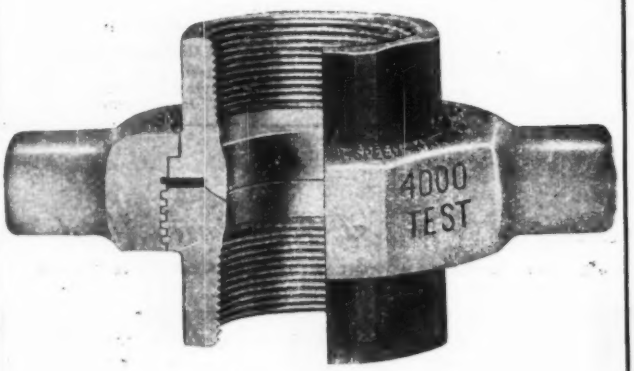

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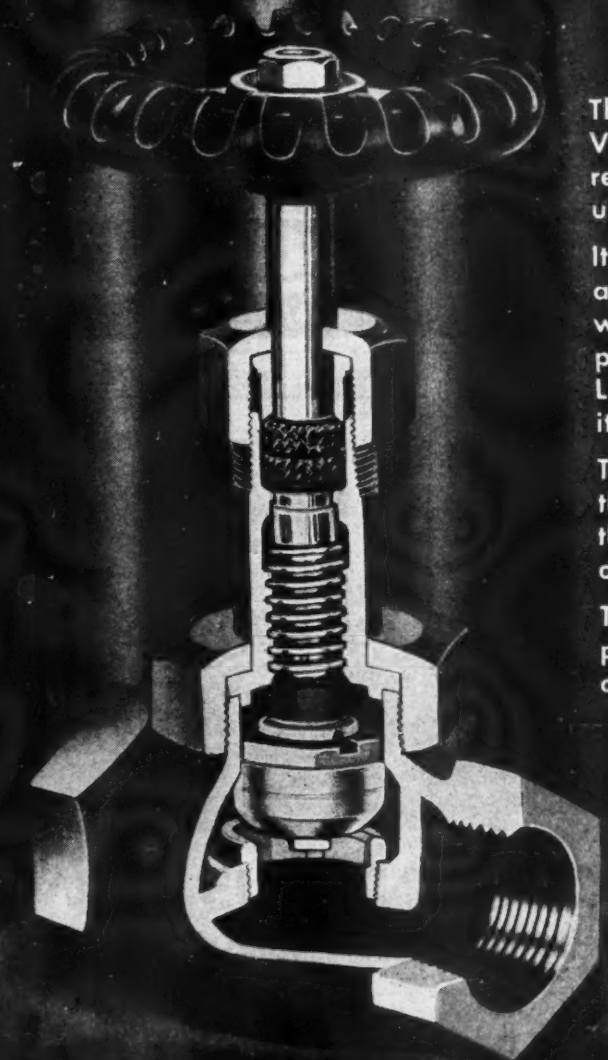
...for High Pressures



This extra-heavy Fairbanks Bronze Valve, Fig. 064, gives exceptional results on steam working pressures up to 300 lbs. at 550°F.

It has long-wearing nickel-alloy seats and discs which can be reground without removing the valve from the pipe line if replacement is necessary. Lugs cast on the inside of seats make it easy to remove these parts.

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The valve can be repacked under pressure when wide open. Top seat is above stem threads and out of the line of flow, protecting it from severe wear and assuring a tight joint when fully open.

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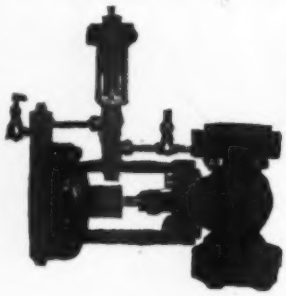

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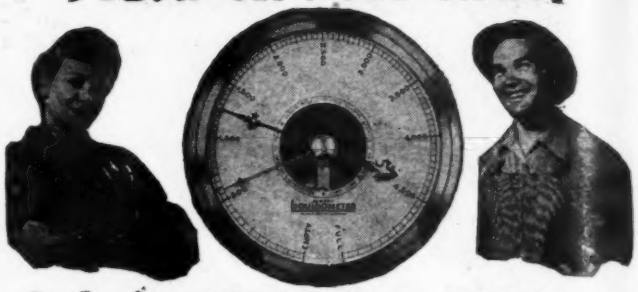

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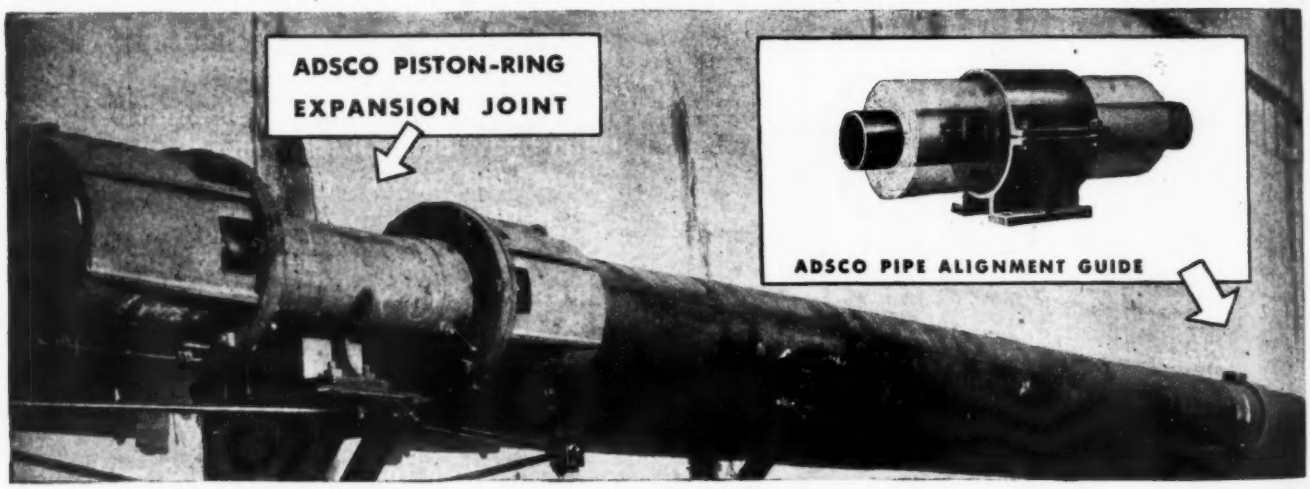

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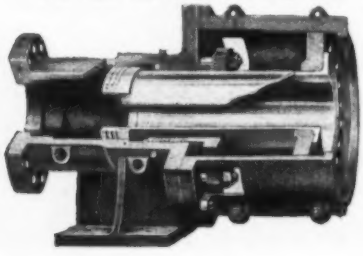

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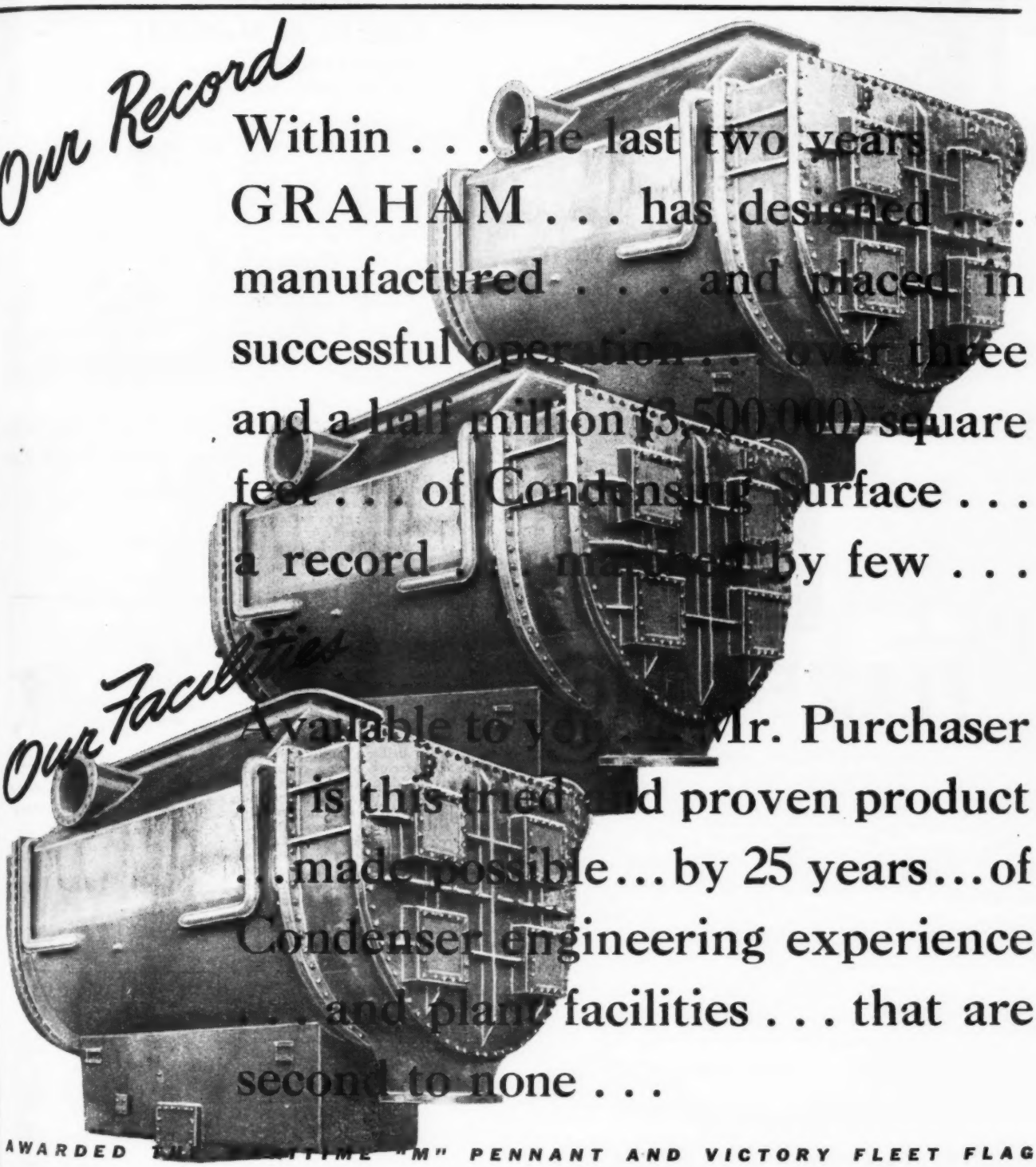

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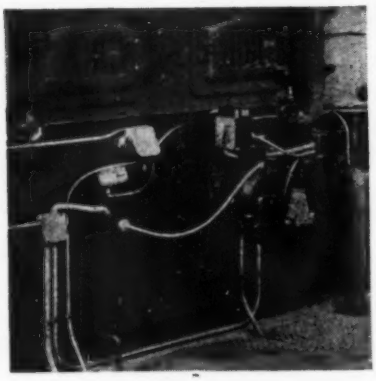

A typical combination gas and oil burner—Flame-otrol installation. (Complete purging cycle, safety shut-off features and pilot light of sufficient size to insure main flame stability).

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—is a Wheelco pioneered electronic achievement, which provides dependable protection against explosion hazards by instantly shutting off the fuel to the burner in case of flame failure, disturbance in the electrical system, or should any condition develop within the instrument itself which might interfere with its operation. Fuel and explosive products accumulation, the source of explosion hazard, is eliminated. Available with automatic or manual ignition, time delay for purging, or other desirable sequences.

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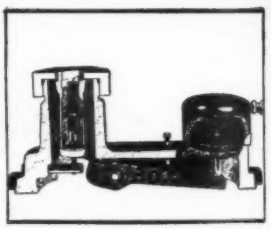
Now—Air Operated Collet Chuck Relieves Second Operation Work on Screw Machines

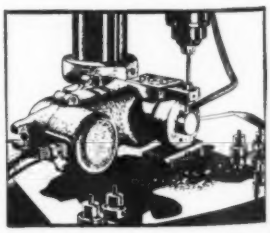
Work formerly requiring automatic or hand screw machines can now be done at much less cost through the combination of this new air chuck and any drill press. The Redmer Air Chuck is a collet air chuck using standard Brown & Sharpe type screw machine collets. The collet remains stationary, the opening and closing controlled by a sleeve action.

By using a collet as the chucking means, slight variations in the diameter of the work as frequently experienced with automatic and hand screw machine products can be permitted without sacrificing accuracy or concentricity. Thus accomplishing an important saving in time and cost.

The air chuck is an ideal tool for holding parts for drilling, milling, slotting, burring, chamfering, boring, counterboring, tapping, threading, reaming and other work where the machine operation should be concentric with the chucking surface. It is adaptable to many different jobs merely by changing collet and stop. This results in saving of valuable production metals and materials. The chuck will take any type work whether round, hex, square or rectangular, and permits full efficiency of the operator, as it is operated by a foot operated valve thus leaving hands free to load and unload—reducing fatigue and cutting unproductive time to a minimum.



An air operated collet holding fixture for precision chucking or machine tools



Chuck can be mounted on angle for angle milling job

Wrigley's Spearmint Gum, too, is a help on the job. For chewing gum helps relieve dry throat, and helps ease fatigue brought on by the strain of work. And at the same time you are chewing and getting the benefits of swell tasting Wrigley's Spearmint, both hands are free and you need not take a "time out." The Army and Navy have recognized these benefits and are now shipping overseas *only,* all of the limited production of Wrigley's Spearmint. When Wrigley's Spearmint can again be produced in sufficient quantity for all, the valuable benefits of Wrigley's Spearmint Gum now being proven on the battlefield will apply to industry here at home.

You can get complete information from Redmer Air Devices Corp., 601 West Washington Blvd., Chicago 6, Ill.

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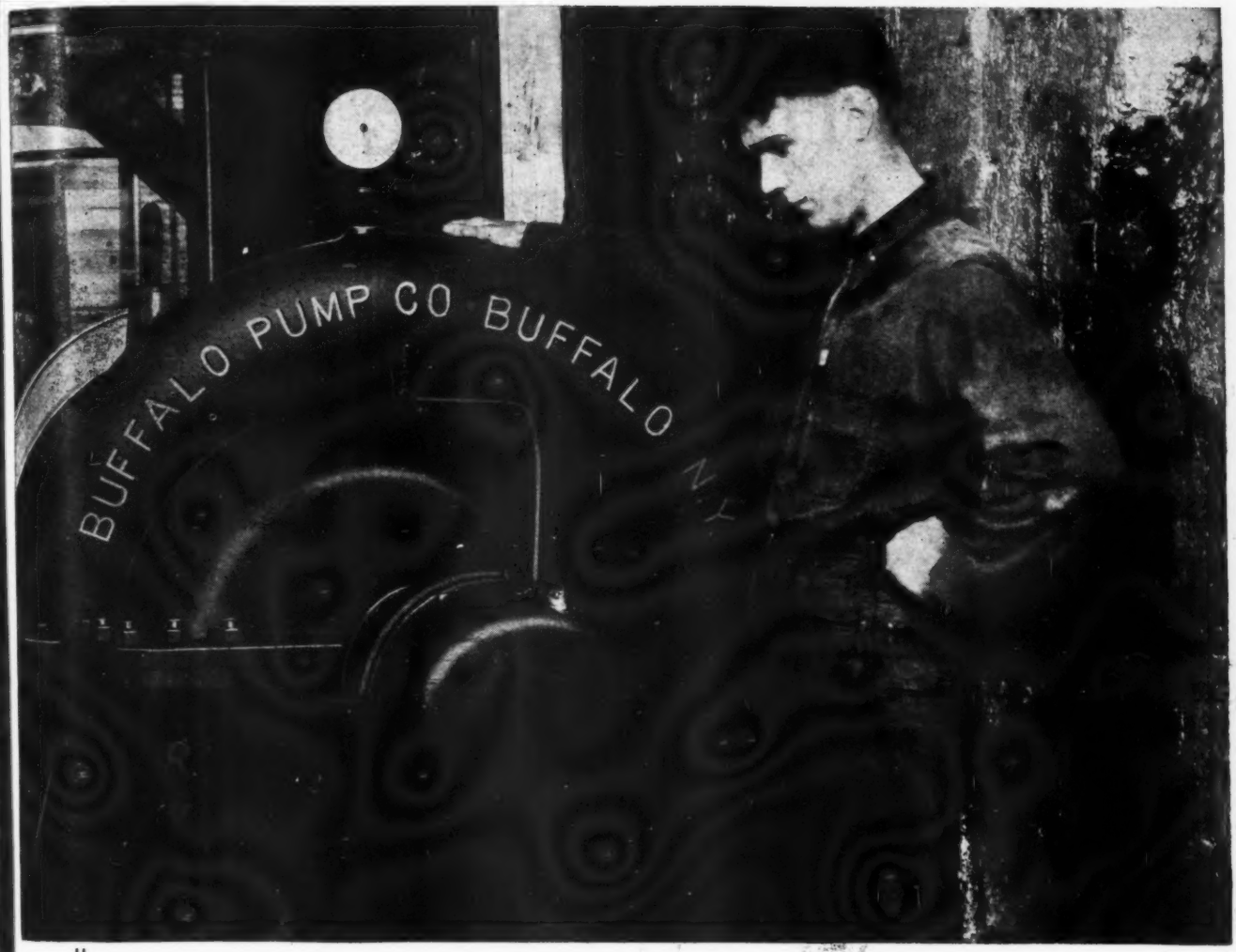

This 5500 gpm Buffalo Pump supplies fresh water from river to mill.

Installed in 1922—

"This pump has been a reliable piece of equipment."

The Superintendent of a large paper mill makes that statement about the Buffalo pump illustrated above. Nothing particularly unusual or spectacular about the service—just 5500 gpm at 30 lbs—clear water—but the pump has been running for 22 years—and our records show no orders for repairs.

After all—when you buy pumps, after you've selected the type you need—what you really want is reliable performance. Why not assure yourself of this by buying "Buffalo"?

Send for a binder of Buffalo Pumps showing the complete line. It belongs in your data file.

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Buffalo Pumps, Inc.

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PUMPS for Paper Mills

RIDGID

The Pipe Wrench that doesn't ask you to repair it's housing

UNCONDITIONAL GUARANTEE
If this Housing ever Breaks or Distorts we will replace it Free
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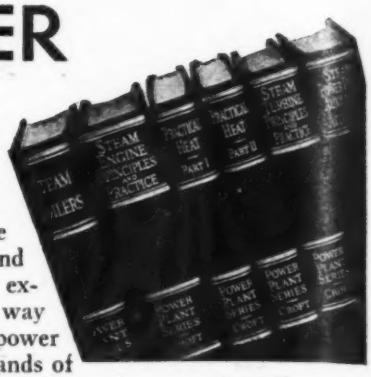

War or peace, keeping the wheels of industry and the nation's utilities turning is a basic job—one there's always room and big money in for the expert. Take the short-cut way to a better-paying power plant job. Do as thousands of others have, to their definite gain—spend a short time daily and systematically reading and using these books.

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COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by Bridgeport Brass Company "Bridgeport" *Headquarters for BRASS, BRONZE, and COPPER*

Protective Scales Retard Corrosion in Condenser Tubing

The wide difference in corrosiveness of waters in various localities or even in the same vicinity, is due largely to variations in protective scale formation. In addition, certain waters may be much more corrosive during the summer due to seasonal excess of carbon dioxide which either prevents the formation of protective carbonate scale or dissolves existing carbonate scale.

Scale Formation Can Be Controlled

While some protective scaling is desirable, heated hard waters in certain localities produce calcium carbonate coatings so rapidly that the inside diameters of pipes are reduced considerably in a short time.

The low calcium content of soft water will not permit the formation of a protective carbonate scale, and allows corrosion to continue unchecked. In such instances one must depend upon:

1. Protective influence of the corrosion product of the metal or alloy involved or
2. The addition of lime, sodium silicate, etc. to the water to counteract the corrosive effect of dissolved carbon dioxide (CO_2).

Soft waters may lead to general and localized dezincification of low copper brasses such as Muntz metal and yellow brass.

Hydrogen Ion Concentration Influences Scale Formation

The hydrogen ion concentration (pH) in water together with other factors determines the probable formation of a protective coating of a mineral or mixture of mineral-corrosion product deposited on the metal surface. In the pH range from 6.8 to 9.3 the solubility of calcium carbonate in water ranges from approximately 15 to 350 parts per million. The calcium carbonate equilibrium point is where a given water will neither dissolve nor form solid calcium carbonate. In actual practice, the calcium carbonate equilibrium point is obtained by determining the pH and alkalinity values at which the water just ceases to act on powdered marble. In connection with this, it is also necessary to have as reference values the alkalinity and pH of the water before it acts on powdered marble.

Common Fresh Water Treatments

It is a common practice to add an alkali such as sodium hydroxide, soda ash, or lime to a soft water to neutralize the free carbon dioxide with the formation of a bicarbonate as indicated in the following:

Lime reacts with carbonic acid to yield calcium bicarbonate and water. The chemical expression describing this reaction is:

$$Ca(OH)_2 + 2H_2CO_3 \rightleftarrows Ca(HCO_3)_2 + 2H_2O$$

Carbonic acid (H_2CO_3) forms when atmospheric carbon dioxide (CO_2) reacts with water (H_2O):

$$CO_2 + H_2O \rightleftarrows H_2CO_3$$

For example, a corrosive natural water with an alkalinity value of 50 parts per million and a pH of 6.0 can be treated so that a pH of 8 or more is attained, which may place it in the scale forming classification.

The results of many years of corrosion research together with engineering data, specifications, and other information are published in Bridgeport's 112-page Condenser Tube Manual, which is free for the asking. Be sure to write for a copy.

★ ★ ★ ★

DUPLEX TUBING

Bridgeport's Duplex Tubing was developed for corrosive conditions too severe for a single metal or alloy. Such a condition is treated as two separate corrosion problems. The metals best for each are selected and combined by a drawing process which produces close mechanical contact.

Bridgeport's Duplex Tubing has many applications. One is in ammonia refrigeration systems where steel pipe rusts away from contact with water, and where copper will not withstand moist ammonia. In this connection, Duplex Tubing composed of steel for the ammonia side and copper or a copper base alloy such as Cuzinal, Admiralty, Cupro-Nickel, or Duronze IV, for the water side has been very successful. Other applications call for the following combinations:

Bridgeport Admiralty, Cupro-Nickel, Red Brass, Cuzinal, Copper or Duronze IV combined with such metals as carbon, steel, stainless, aluminum, or Monel metal.

The Bridgeport Brass Company has published a new Technical Bulletin on the applications and installations of Duplex Tubing which is available for the asking.

Note: Bridgeport products are supplied in accordance with existing priority regulations.

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YARWAY GUN-PAKT EXPANSION JOINT

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YARNALL-WARING COMPANY
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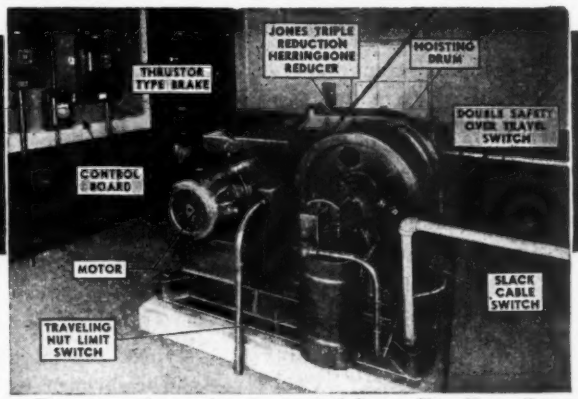
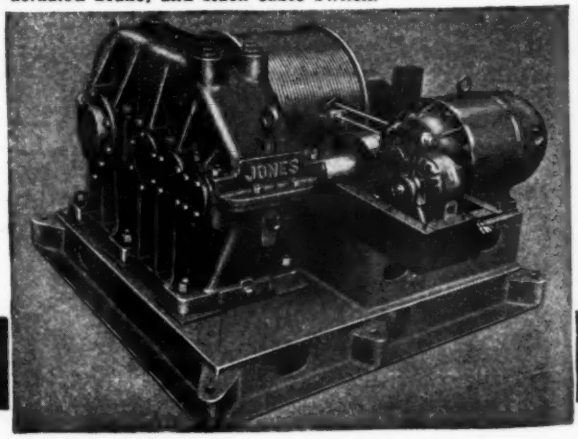
For Economical Material Handling
JONES SKIP HOIST DRIVES



• The view above shows a typical Jones Skip Hoist Drive installation while the view below shows one of the Jones units equipped with traveling nut type limit switch, motor actuated brake, and slack cable switch.



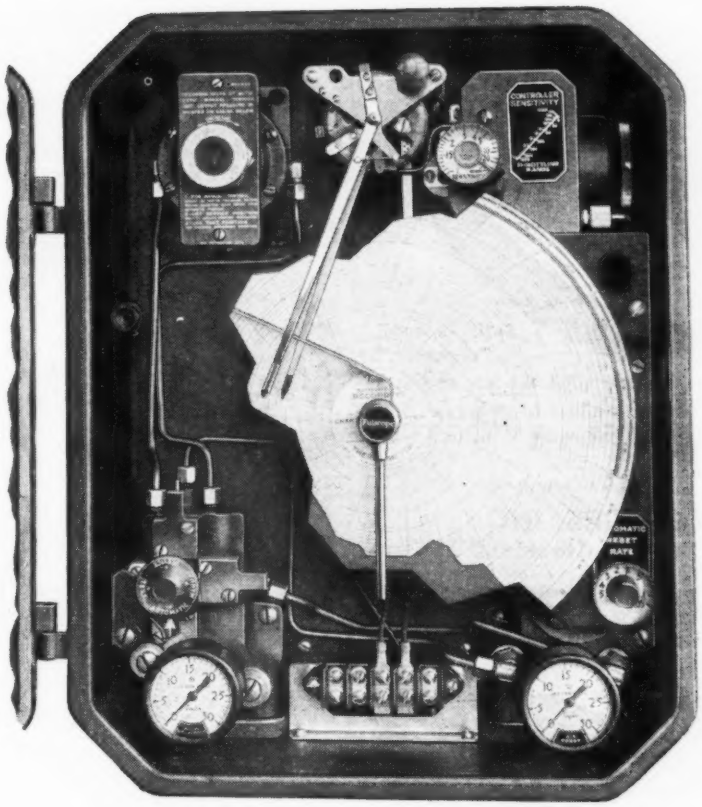
FOR speedy operation, reliable service and over-all economy the Jones Skip Hoist Drive has made a name for itself in a wide variety of material handling service. These skip hoist drives are built as complete units by the Jones organization in several types with base to take any motor specified by the purchaser. They are equipped for all the modern protective devices such as cam or nut type limit switches, solenoid or disc type brakes and slack cable switches. The drives are single, double, or triple reduction Jones Herringbone Speed Reducers, built to stand up under the many years of pounding that a skip hoist drive has to take. The shafts are supported in roller bearings, with rolling action, rack generated gear and pinion teeth to insure easiest possible starting with low starting-peak loads. All reducer bearings and gears are automatic oil-bath lubricated.

The Jones organization has an extensive file of information on skip hoist drive problems and will be pleased to work with you on any problems involving such applications

W. A. JONES FOUNDRY & MACHINE CO.
4423 Roosevelt Road, Chicago, Illinois

Jones HERRINGBONE—WORM—SPUR—GEAR SPEED REDUCERS
CUT AND MOLDED TOOTH GEARS • V-BELT SHEAVES
ANTI—FRICTION PILLOW BLOCKS • PULLEYS
FRICTION CLUTCHES • TRANSMISSION APPLIANCES

WHAT! No man inside?



REMEMBER the robot chess-player that astounded the world during the Gay Nineties—until someone discovered there was a man inside? If you've watched a Taylor Fulscope Controller at work, we wouldn't blame you for thinking we install a Ph.D. in every instrument because it does so many things to such an uncanny degree of accuracy.

It's available with 5 completely interchangeable forms of control: (1) Fixed High Sensitivity of (2) Adjustable Sensitivity with (3) Automatic Reset or (4) Pre-Act or (5) both Automatic Reset and Pre-Act . . .
or, if desired, the new Four-Position Automatic-To-Manual By Pass (as illustrated above) . . .
or Taylor Pneumatic Set . . .
or Remote Pneumatic Transmission . . .

And here are a few of the places where it's helping to keep things under control:

- De-superheater temperature
- Steam distribution lines
- Feed water heaters
- Steam pressure on gas or oil-fired boilers
- Batch process control systems
- Continuous process control systems

The Taylor Fulscope Controller is one of the most versatile, flexible instruments ever built. It's easy to adjust and maintain and it's adaptable to almost any application where you need to indicate, record, or control temperature, pressure, humidity, flow or liquid level. Ask your Taylor Field Engineer. Or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

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Less skilled help can do
FIRST-CLASS pipe welding
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WEDGE Chill Rings with the patented SPLIT Feature have relieved labor shortage for many. They assure proper spacing and alignment which makes it possible for less skilled help to do first class work and enables skilled help to do more. The alignment is practically automatic because the operator merely slips the second section on the ring without the use of clamps or guides. You can weld pipe CHEAPER and BETTER with WEDGE Chill Rings.

Split Feature Patented

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WEDGE CHILL RINGS **SAVE MONEY**

For Quality
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CUT GEARS-CUT RACKS
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Our large modern plant, fully equipped and in mass production can supply your requirements for Gears, Sprockets and Racks, in every particular.

You'll like our methods and our service. We also do precision surface grinding and can offer you time on our machines operating day and night.

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INDUSTRIAL GEAR MFG. CO.
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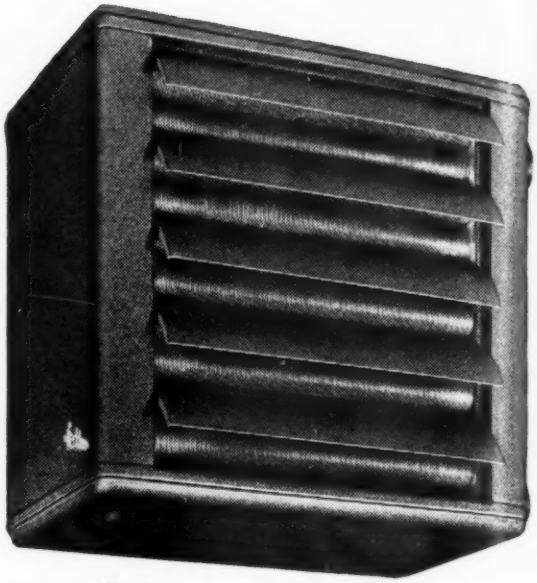

A word to
MEN OF MANAGEMENT
About their
POWER PLANT ENGINEER

Your Power Plant Engineer would not tell you this, so we are going to do it for him.

He has been — and still is — going through one of the most difficult periods in his experience. He is working under heavy handicaps of help shortage, difficulty in securing new or operating equipment, fuel shortages, and a host of other conditions which have taxed his ingenuity to the utmost.

He has done his best to keep factory and office workers warm, and our hat is off to him!

As manufacturers of Fedders Unit Heaters, we have made it a policy to smooth the road for heating men by gearing our orders to our production to make possible common sense delivery promises and live up to them during these trying times.

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For Piston Rods of all Engines and Compressors
C. LEE COOK MANUFACTURING CO., INCORPORATED
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CATALOG NO. 440

FREE... TO DESIGN AND OPERATING ENGINEERS

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THIS CATALOG, just off the press, covers the entire subject of Metallic Rod Packings and the materials of which they are made . . . It gives you complete details and illustrations of a comprehensive line of engine and compressor packings, including the higher pressure packings being used by the **Chemical** and **Petroleum** industries. The material is arranged and indexed to facilitate selection of the correct packing for a particular type of equipment and service . . . Valuable information on packing application and maintenance is also included, together with engineering tables on rod material, gases and other data pertinent to the subject of packings . . . A complimentary copy is yours for the asking if request is made on your company letterhead. If you use the coupon, just pin or paste it to the letterhead.

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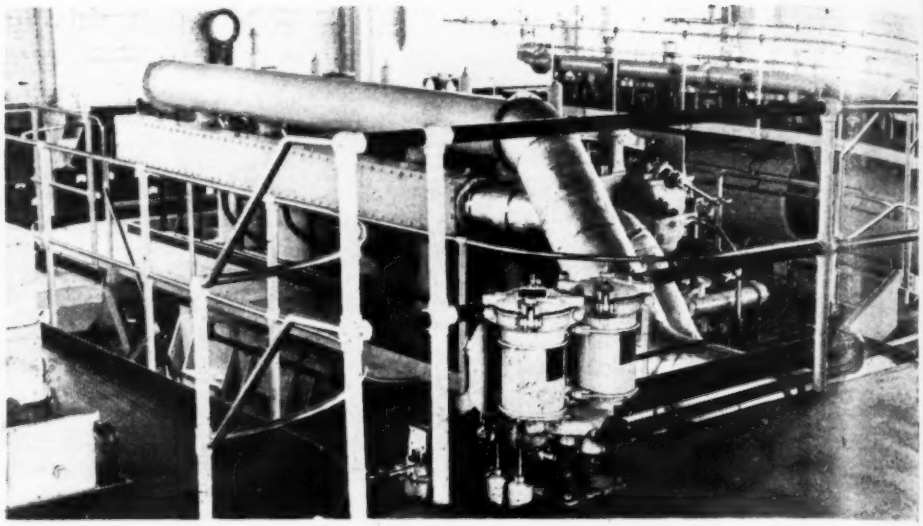
6 NUGENT FILTERS...

Help Protect Diesels at Maquoketa, Iowa Electric Plant.



TODAY when the total generating capacity of the nation's power plants is vital, it is more important than ever to eliminate the possibility of shut-downs. At the Maquoketa Municipal Electric Plant, Nugent Filters help to insure uninterrupted service by eliminating dirt from the fuel oil used in the Diesel engines.

These rugged filters will remove dirt particles as small as .0017" to assure virtually 100% clean oil. This is the kind of protection that is essential for smooth, dependable Diesel operation. Available in a wide range of sizes for Diesel engines from 1 to several thousand HP in single containers. Write for bulletins today.

• The 1200 HP. eight cylinder mechanical injection type McIntosh-Seymour Diesel engine shown above is one of four Diesel engines at this location equipped with Nugent Filters. The Duplex unit shown, is installed between the day tank and the engine to cleanse the fuel oil.

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402 N. Hermitage Ave., Chicago 22, Illinois

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ESTABLISHED 1897

Save Fuel- Heat Uniformly, Efficiently

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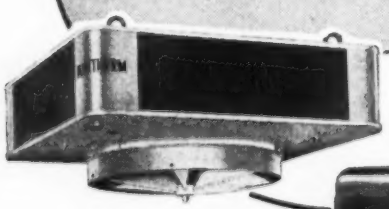
AIRTHERM

COPPER COIL, STEAM

UNIT HEATERS



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Deflectors are designed so that air velocities are increased without the necessity of extra power. Air is distributed evenly from the fans through the condenser eliminating "dead spots" and guaranteeing you full efficiency from every ounce of steam expended.

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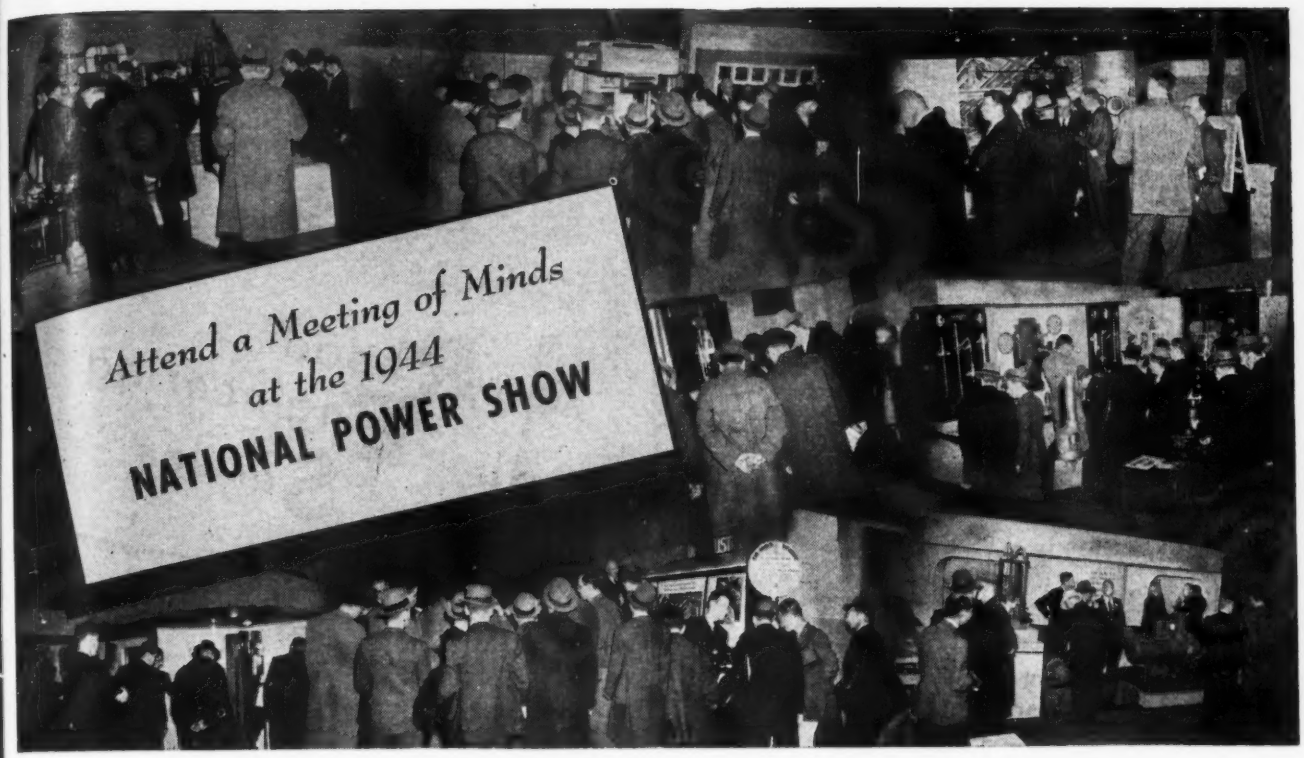

Gather timely essential ideas

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You can attend a huge pooling of practical, tested ways and means of maintaining and using the power load which "backs the attack"—at the 16th National Exposition of Power and Mechanical Engineering. There, engineers and executives concerned with the efficient operation, production, transmission and utilization of power, can get first-hand help on the special problems of 1944—and 1945. Engineering specialists in attendance at scores of thought-stimulating exhibits, will furnish latest advice on the use and maintenance of their equipment. Displayed also will be exhibits of tools for various power production and maintenance uses.

Sharpen your plans for needed

post-war equipment and methods

This show can provide an ideal opportunity for you to check your thinking on the problems of modernization and transition to peacetime economy . . . rebuilding after Victory. You can see many new products—some of them available for the first time . . . discuss new developments that will affect power plant operation . . . decide on their practicability for your needs. You can obtain direct answers to many questions—answers which may shape your future plans sharper and clearer.

Plan to attend the National Power Show this year, with as many of your associates as can be benefited. See for yourself the many interesting and informative exhibits. Exchange up-to-the-minute experiences with other power engineers. Take back to your job a new and revitalized outlook.

Both FREE

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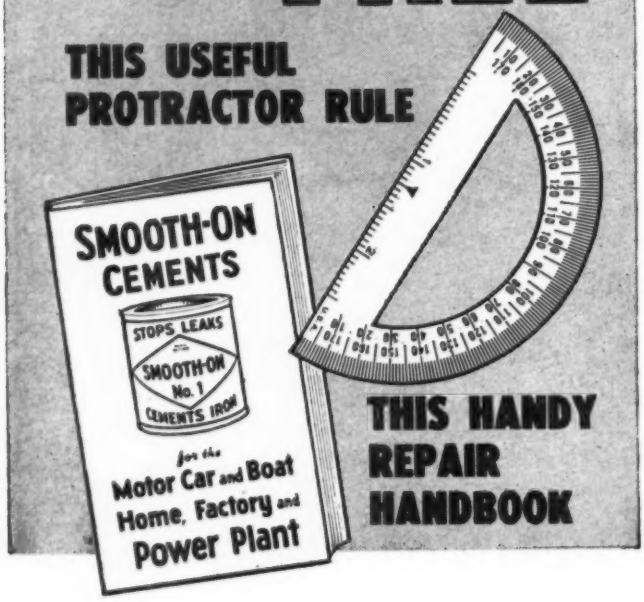

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1. An accurate metal protractor clearly marked, with angles reading in both directions and the straight side scaled in inches.

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This repair handbook shows how you can SEAL CRACKS in casings or shells of pumps, heaters, process apparatus, valves, machinery castings, pipes, and pipe fittings, etc. . . . STOP LEAKS at seams, threaded or flanged joints, bolts, rivets, etc. . . . TIGHTEN loose screws, bolts, handles, pulls, fixtures, etc. on tools, utensils . . . WATERPROOF wet collars, concrete, brick or stone floors, walls, etc.

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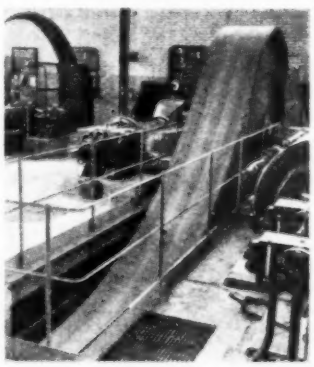
Longer belt life is but one of the savings Rhoads Engineering Service—based on many years of leather belting manufacture and application—can offer. Economies also follow, through greater drive efficiency and the lower maintenance time and trouble needed. Be sure to get our help when planning a new drive or changing an old one.



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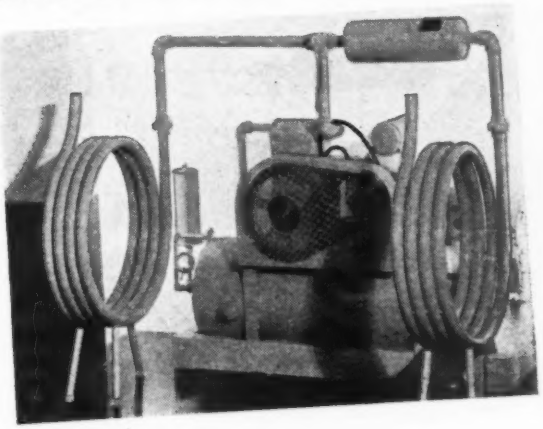
ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGIN

BURGESS SNUBBER BULLETIN for Diesel Exhaust Noise Control



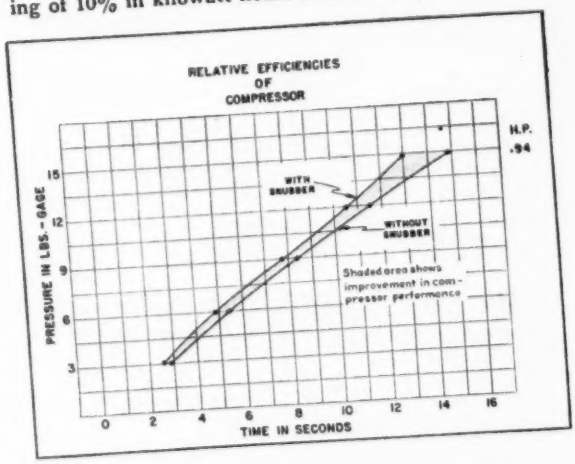
A Burgess Air Intake Snubber installed near a "starved" compressor will smooth out the airflow through the intake pipe and restore intake conditions to normal. This fact has been demonstrated by tests on a compressor using two identical pipe lengths that would starve the compressor. One intake had no Burgess Snubber; the other was Snubber-equipped. The compressor was operated with the un-snubbed intake and the time to attain a specific tank pressure was noted with a stop watch. The test was repeated, using the snubbed intake system, and the time again noted. The results are shown on the chart in which the shaded area reveals the improvement in compressor performance when a Burgess Air Intake Snubber is used on a starved compressor.

The wattage drawn from the power line by the motor was the same for each test, but the shorter operating time with the Snubber-equipped air intake made a saving of 10% in kilowatt hours consumed by the motor.

STARTLING PERFORMANCE — INTAKE SNUBBER STEPS UP COMPRESSOR EFFICIENCY

The power required to operate a compressor is roughly proportional to the air delivered. This condition may change if the pipe on the intake is of such length that it causes "supercharging" and overloads the motor.

On the other hand the intake pipe may reduce the volumetric efficiency of the compressor by 10% or more without an equivalent reduction in horsepower. This condition occurs when the air column in the intake pipe oscillates in opposition to the compressor piston. In either case, intake noise is increased.



QUIET INTAKE AND EXHAUST ON MAQUOKETA MUNICIPAL PLANT

Ma-quo'-ke-ta, Iowa, is a strange name to remember and a hard one to pronounce, but that has nothing to do with this small city's modern progressive spirit. One evidence of modern Maquoketa is the Municipal Light and Power Plant shown above.

Although the Maquoketa power plant is relatively new and contains fine equipment of the latest design, it is no different, in one respect, than any other utility depending on Diesel engines for power. Diesel engines are noisy, and unless properly quieted produce disturbances which cannot be tolerated in populated areas.

The job of quieting at the Maquoketa plant was thoroughly accomplished. The 2380 hp Busch-Sulzer Diesel was double Snubber-equipped —a Burgess Spark Arrester-Snubber was installed to subdue the exhaust roar and to remove sparks, soot, and solid matter from the exhaust gas. A Burgess Air Intake Snubber was inserted to prevent "pumping" intake noise without choking the air intake pipe.

A Burgess Air Intake Snubber and a Burgess Spark Arrester-Snubber make a logical combination for large internal combustion engines.

LOOK FOR THESE BURGESS SNUBBER CONSTRUCTION FEATURES

1. Dished head eliminates excessive weight yet reduces "drumming" effect otherwise caused by successive pounding of gas slugs.
2. Shells double wrapped throughout (laminated) to give added strength and to reduce excessive vibration or shell noise.
3. Welded throughout for greater strength and longer life.
4. Internally designed to give proper silencing to engine air intake and exhaust, without impairing the engine efficiency.

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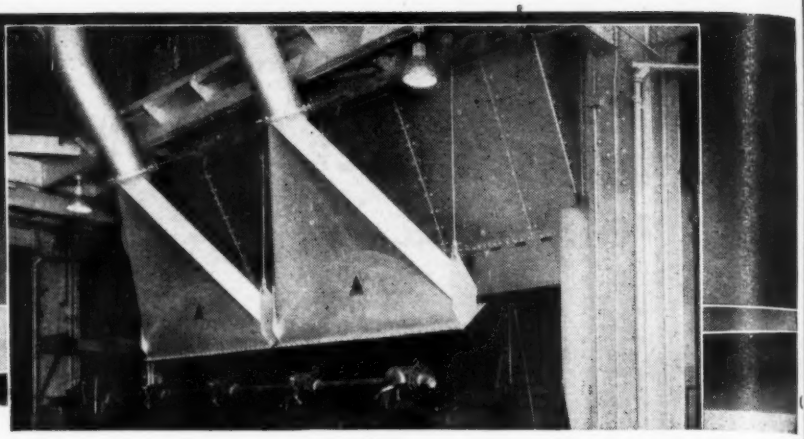
ORIGINATORS OF SNUBBING PRINCIPLE FOR QUIETING DIESEL EXHAUSTS—BURGESS—ORIGIN
COMPLETE SATISFACTION IN EXHAUST AND INTAKE QUIETING—SPECIFY BURGESS SNUBBERS—FOR CO

We know why CONICAL distributors won't segregate coarse and fine coal—but, do YOU?



● Segregation leads among the enemies of efficient combustion . . . and with this in mind STOCK Engineering Company developed the CONICAL Non-Segregating Coal Distributor, designed to deliver a uniform mixture of coarse and fine coal across stoker hoppers. Highly successful operation-results in hundreds of plant installations have proved that the CONICAL Distributor *will* eliminate segregation, insure complete combustion, increase CO_2 percentage and increase fuel burning capacity of stokers.

For a clearer understanding of the principles of CONICAL Distribution look over the diagrams at the right. As you read compare the CONICAL Distributor with flat-chute distribution methods and results.

1. If a number of pieces of coal are placed at the apex of a cone, the axis of which is vertical, and then released, they will slide down any element of the cone.

2. A segment of a cone will produce the same result. The flow of coal particles is parallel—and this plus the cone shape produces a uniform distribution.

3. In order to deposit the coal particles along a straight line the cone segment is cut by a vertical plate, as in Fig. 3. The addition of two side plates, an entrance flange and a similar conical segment as a cover plate, completes the CONICAL Non-Segregating Coal Distributor.

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A FREE BOOKLET, illustrating and explaining further advantages of the CONICAL Non-Segregating Coal Distributor will be sent at your request. Address inquiries to Stock Engineering Co., 715 Hanna Bldg., Cleveland 15, Ohio.

CONICAL Non-Segregating Coal Distributors ★ **S.E.Co. Coal Valves and Coal Scales**

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SMOKE and COMBUSTION INDICATORS, CONTROLLERS and RECORDERS

. . . the tell tale of combustion efficiency . . . show the boiler haze . . . save fuel . . . permit automatic burner adjustment.

Simple in design . . . rugged in construction, they operate efficiently with a minimum of maintenance.

WYD-ANGLE PERISCOPE for visual operation

ELECTRONIC HAZE GAGE for automatic signal operation

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Indicators, Controllers and Recorders for SMOKE & COMBUSTION . . . SPECIFIC GRAVITY . . . TURBIDITY . . . FLAME FAILURE . . . INDUSTRIAL and SAFETY APPLICATIONS

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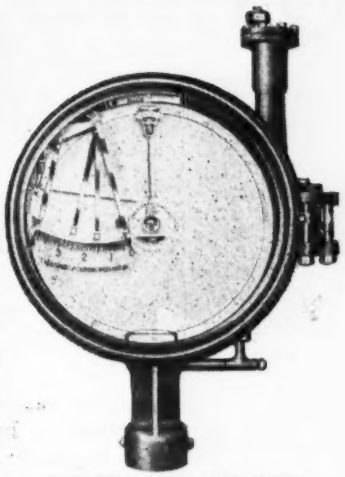
All these EXTRA METER VALUES at NO EXTRA COST!

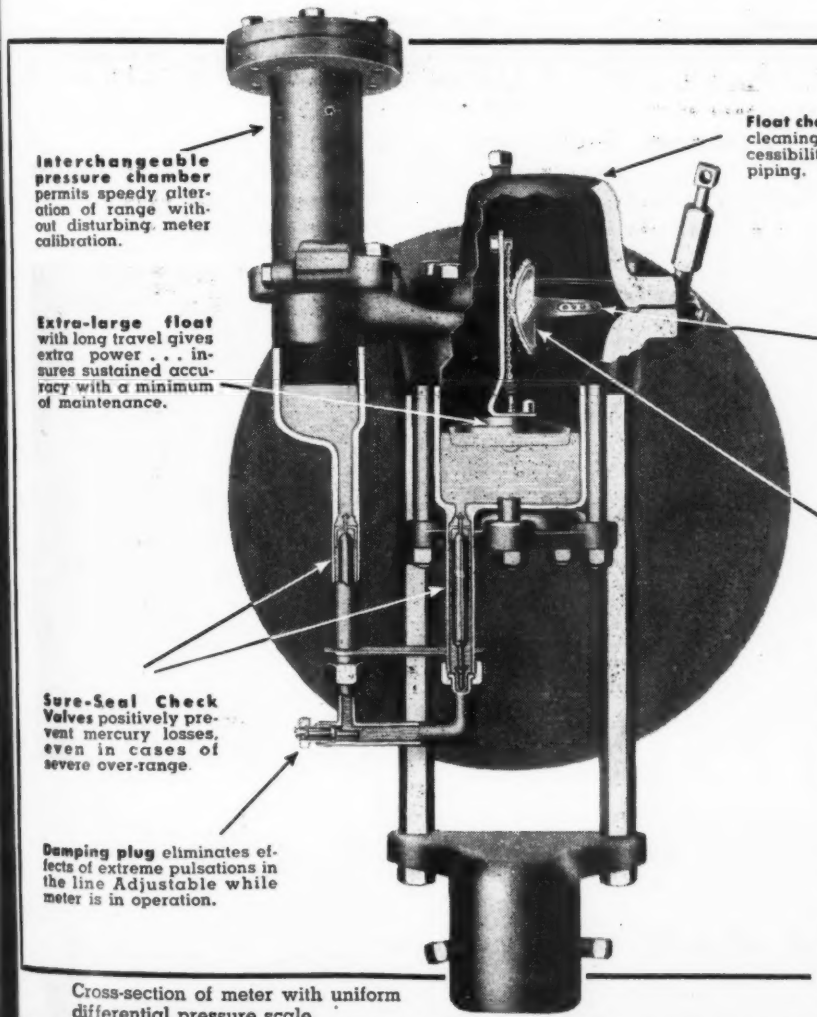
It's just plain "good business" to make sure you get full value from your meter investment. Over 45,000 installations of Foxboro Flow Meters have demonstrated that these meters give you "more for your money!"

Foxboro Flow Meters cost no more. Yet, their *engineered simplicity* provides important extra values . . . easier installation . . . simpler, less-frequent servicing . . . positive saving of mercury . . . unvarying accuracy throughout years of use.

Special Foxboro features that produce these extra values are "spotlighted" in the illustration. They are some of the major advances in meter design that Foxboro has introduced during the last 30 years of leadership in flow meter development and installation.



FOXBORO UNIVERSAL FLOW METER records temperature, pressure and flow on same chart. Uniform flow scale.


Interchangeable pressure chamber permits speedy alteration of range without disturbing meter calibration.
Float chamber designed for easy cleaning. Provides complete accessibility without disconnecting piping.
Extra-large float with long travel gives extra power . . . insures sustained accuracy with a minimum of maintenance.
Pressur-Tite Bearings for transmitting float motion to pen arm. No stuffing box . . . no packing . . . practically frictionless.
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Sure-Seal Check Valves positively prevent mercury losses, even in cases of severe over-range.
Damping plug eliminates effects of extreme pulsations in the line Adjustable while meter is in operation.

Cross-section of meter with uniform differential pressure scale.

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Foxboro engineers will be glad to place their specialized knowledge of flow measurement at your service for better metering installations. Write for detailed Bulletin 200-6. **The Foxboro Company, 68 Neponset Ave., Foxboro, Massachusetts, U. S. A.**

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WHITLOCK LUBRICATING OIL COOLERS

Specially designed to maintain proper lubricant temperature at oil reservoir, the Whitlock lube oil cooler carries off heat generated at the bearings and helps maintain the oil film vital to modern high speed machinery. The lube oil cooler with outside packed floating head, shown above, was designed and built by Whitlock for a specific job and is one of thousands of Whitlock Heat Exchangers now serving with efficiency and economy. Our engineers will gladly advise on your problem.

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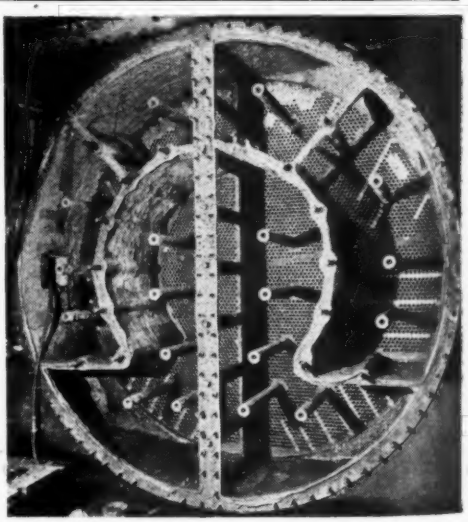
Condenser Retubing *plus* Redesign —on time!



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They wanted us to

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And that's what Ballou did—effectively and on time—this way—

Repaired cracks in both tube sheets by "know how;" saved the cost and delay of new tube sheets.

Redesigned and furnished the air box and new air baffles.

Relaned cooling surface for higher efficiency.

Cut out old tubes and installed 5500 new tubes, closed up the job and proved it tight.

One of the most important parts of the Ballou name is SERVICE—designing, fabricating, installing, repairing, cleaning. And if you want the job fast, Ballou men will work their heads off to give it to you. Write or call us.

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STAYNEW *automatic* AIR FILTER

Engineered for Greatest Possible Efficiency and Economy . . .

This latest model Staynew Automatic Filter operates on the principle of dust impingement. Dust is caught by moving filter panels moistened with oil from a reservoir. The panels are automatically timed to operate at pre-determined intervals, depending on the amount of dust to be removed and the air velocity. The filter possesses a number of unusual features which increase efficiency in dust removal and reduce operating costs. Several of these features are fundamental in design and found in no other filter. The result is a rugged, high-efficiency unit with which extremely large volumes of air can be filtered at low cost.

A. Quickly demountable panel sections. Filter medium is special woven mesh, wire cloth protected. This medium, moistened with oil, presents a maze of small, finely divided, irregular orifices which break up the air stream. Dust particles are impinged on the sides of these orifices.

B. Virtually friction-free construction. Ball bearings throughout. Roller bearing chains carry filter panels. Both panels of a 13 ft. unit may be easily turned with one hand!

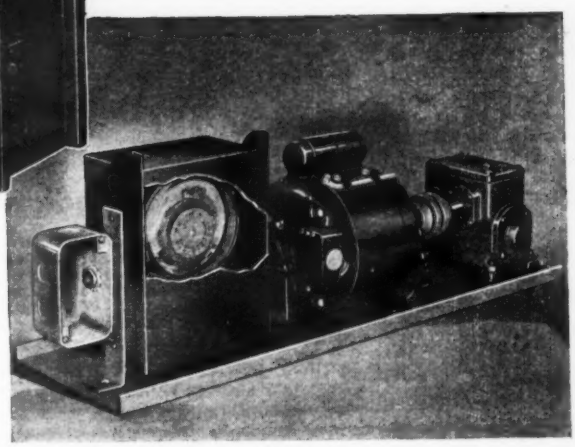
C. Absolutely rigid one-piece pressed channel side plates.

★ There are *two* series of endless moving filter panels. Each series provides two stages of filtration—four stages in all. The double series of moving filter panels is exclusive with Staynew. Efficiency is two-fold.

★ Direction of curtain travel is such that air leaves the clean side always. This is an exclusive feature.

CONTROL MECHANISM INTEGRAL PART OF FILTER UNIT . . *Just one connection to be made to electric line.*

Telechron motor-driven time switch with *silver contacts*. Time Switch is mounted in a glass dust-proof case. Power transmission from sturdy rubber-mounted motor through 400-1 gear box and 3-1 chain and sprocket. Every gear, pinion, bearing, roto timing device, panel section, side-piece—in fact, every major and minor detail of this filter is of the highest possible quality—designed for efficiency, long wear and complete satisfaction.



Write for Complete Data. Also Catalog Describing Filters for Engine, Pipe Line and Other Service.

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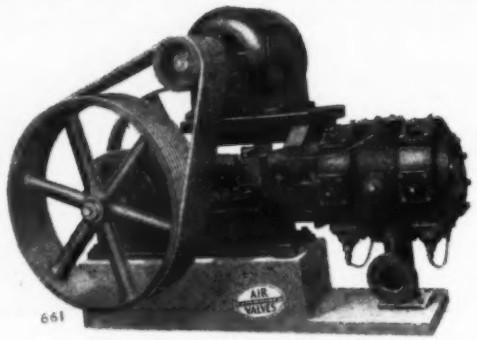
"AIR FILTER HEADQUARTERS"

INCREASE YOUR PROFITS!



Pennsylvania Single-Stage
Roller Bearing Compressor

Every dollar saved in maintenance cost is a dollar more profit. Many thousands of this kind of "profit dollars" have been earned for users of PENNSYLVANIA compressors because their maintenance cost is so extraordinarily low.

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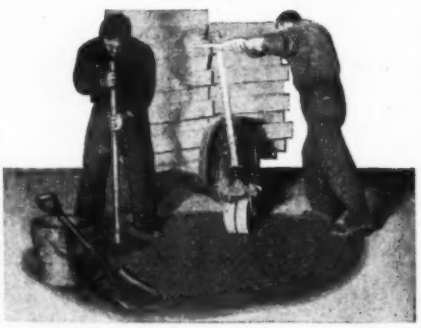
WITHOUT HALTING TRAFFIC

No longer is it necessary to close off an area of concrete floor while waiting for newly installed patches to set. Flexrock offers a new plastic repair material which is ready for traffic almost the moment it's put down.



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There is no waiting. Simply shovel INSTANT-USE into the hole or rut—tamp—and your floor is restored to solid smoothness . . . back in service without delay. Tough INSTANT-USE bonds tight to old concrete, makes long-lasting heavy duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

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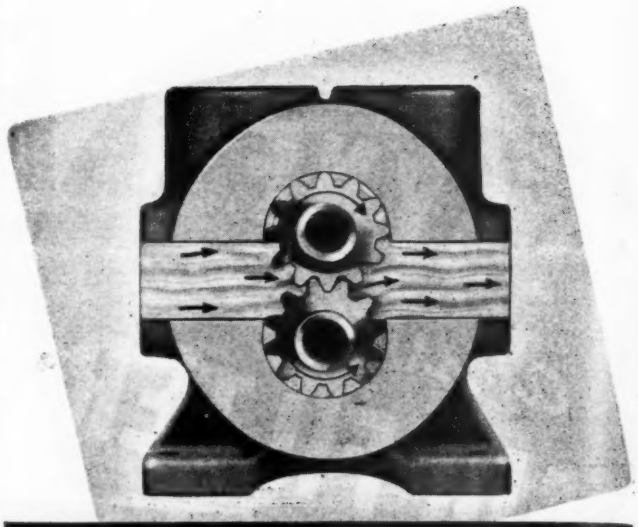
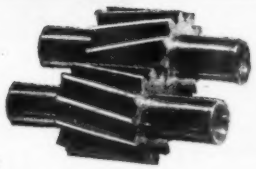


What Could Be Simpler than just 2 moving parts?

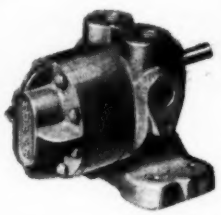


That's all there are in a Roper pump . . . just 2 equal size pumping gears. Their action produces a vacuum which draws the liquid into the suction opening. From that point it is carried between the teeth of the gears to the opposite side of the pump where the gear teeth mesh forcing the liquid into the discharge line.

When this simple principle was introduced back in 1857, it was the most economical and satisfactory way of moving liquid. Today, after continued refinements and improvements, the time-tested Roper principle remains basically the same, for no better way of doing the job has yet been found. The trouble-proof simplicity of the Roper design, will pay you dividends in *increased* smoothness, greater efficiency and longer service.

ENGINEERING SERVICE

Roper Sales and Engineering Service reaches from coast to coast. All representatives have a thorough knowledge of engineering and a wealth of practical experience. Their services are promptly available to help you solve your pumping problems.



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With many illustrations, cut-away views, drawings, dimension and pumping capacity tables and complete information on Roper Pumps.

ROPER
Rotary Pumps

DEPENDABLE SINCE 1857

GEO. D. ROPER CORP., ROCKFORD, ILL.

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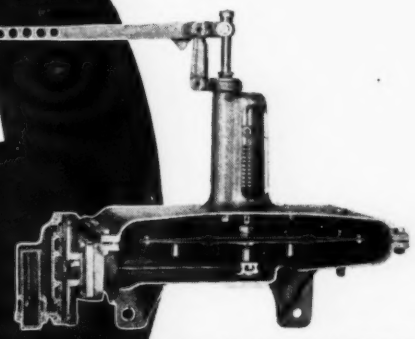
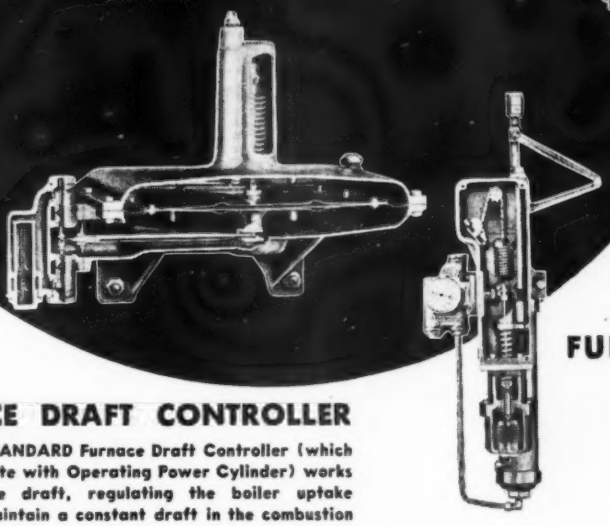
. . WITH *Savings* IN FUEL

CASH STANDARD AUTOMATIC COMBUSTION CONTROL SYSTEMS



AIR FLOW CONTROLLER

This CASH STANDARD Air Flow Controller meters the air needed for combustion. Install it near its damper. It is not affected by changes in fuel bed resistance or any other variables, because it meters air supply according to the differential pressure through the gas passages of the boiler, doing its part to insure perfect combustion.



FURNACE DRAFT CONTROLLER

This CASH STANDARD Furnace Draft Controller (which comes complete with Operating Power Cylinder) works from overfire draft, regulating the boiler uptake damper to maintain a constant draft in the combustion chamber.

FUEL FEED CONTROLLER

This CASH STANDARD Master Controller automatically regulates fuel feed. Locate it conveniently. Working from boiler pressure, it will adjust the rate of combustion by regulating the rate at which fuel (any kind of fuel) is supplied to the boiler furnace. And it will adjust the Air Flow Controller so the correct amount of air is supplied for proper combustion —hence, money saving.

THE simple way to get the equivalent of added boiler capacity for immediate and future power and processing needs is to equip your present boiler with CASH STANDARD Automatic Combustion Control. Then you have constant automatic attention that works continuously in your favor in the matter of more steam . . . less fuel . . . savings in maintenance.

CASH STANDARD instruments maintain the proper proportion of air supply continuously so that you maintain effective combustion . . . where such controlled combustion exists, there is no under-firing to cut steam supply nor over-firing to waste fuel. Through the proper operation of the stack damper, heat is not absorbed by excessive air above the fire and thereby lost through the stack . . . the heat goes direct to the boiler water to give you more steam.

CASH STANDARD Units can be combined to make a most accurate and dependable Automatic Combustion Control System to meet any condition and work on any boiler with any kind of fuel.

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A. W. CASH COMPANY
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Boiler Compound Gives UNIFORM PROTECTION When Injected with MANZEL CHEMICAL FEEDERS

When a Manzel Chemical Feeder is installed on a boiler, every gallon of water gets exactly the right amount of chemical. Installed on the boiler feed pump, the Feeder injects a pre-determined amount of chemical on each stroke. This is the surest way to discourage the formation of scale.

Manzel Feeders are simple, sturdy, metering pumps. Feed is easily adjusted and very accurate. Only the pumping unit comes in contact with the chemical and it is easily removed for cleaning or replacement. The drive mechanism runs in oil.

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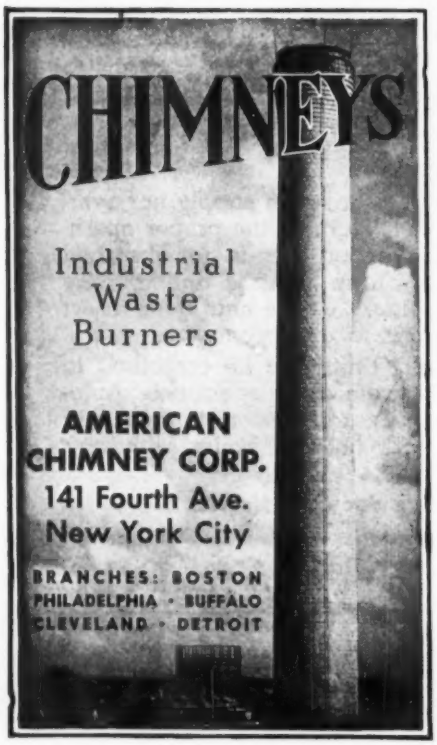

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GET MORE POWER FROM LESS FUEL

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For fire tube and water tube boilers. Rapid vibration quickly breaks scale's grip on tubes. Fast, perfect cleaning—down goes fuel expense! Just try one! Also ask about our Mohawk power-driven Soot Scraper.

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WHERE TO BUY
Section

supplements other advertising in this issue with these additional announcements of products and services essential to efficient and economical power operation and maintenance. Make a habit of checking this page, each issue.

Departmental Staff
POWER

Deaerating Hot Process Softener

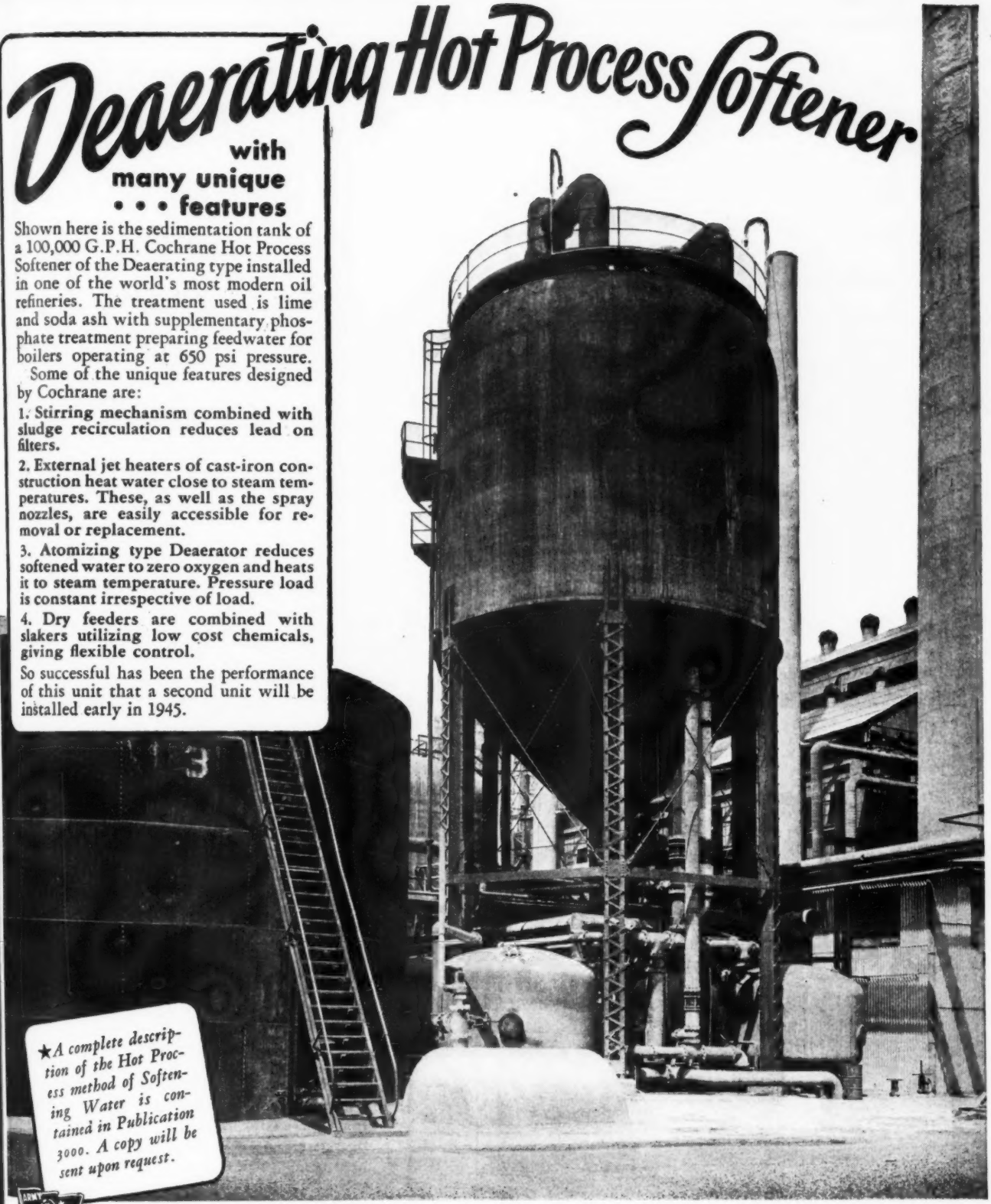
with many unique • • • features

Shown here is the sedimentation tank of a 100,000 G.P.H. Cochrane Hot Process Softener of the Deaerating type installed in one of the world's most modern oil refineries. The treatment used is lime and soda ash with supplementary phosphate treatment preparing feedwater for boilers operating at 650 psi pressure.

Some of the unique features designed by Cochrane are:

1. **Stirring mechanism combined with sludge recirculation reduces lead on filters.**
2. **External jet heaters of cast-iron construction heat water close to steam temperatures. These, as well as the spray nozzles, are easily accessible for removal or replacement.**
3. **Atomizing type Deaerator reduces softened water to zero oxygen and heats it to steam temperature. Pressure load is constant irrespective of load.**
4. **Dry feeders are combined with slakers utilizing low cost chemicals, giving flexible control.**

So successful has been the performance of this unit that a second unit will be installed early in 1945.



★A complete description of the Hot Process method of Softening Water is contained in Publication 3000. A copy will be sent upon request.

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FYR-FEEDER stoker firing not only saves coal, but also permits you to burn any kind of bituminous coal available—screenings or sweepings, any melting point of ash, free-burning or coking coals. WET COAL is no handicap . . . Fyr-Feeders are designed to handle WET or dry coal.

FYR-FEEDER burns fines in suspension, burns larger pieces on grate. Coal is spread over entire fuel bed. Thin fuel bed—no clinkers. Fires can be cleaned in two minutes! Suitable for large or small boilers. Very little maintenance cost. In many cases FYR-FEEDER stokers have made it unnecessary to add another boiler to handle increased loads. WRITE FOR CATALOG.

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SEARCHLIGHT SECTION

WANTED

Continued from pages 327-390

Continued from pages 372-390

WANTED
1—Winkler Stoker #40 1200 lb. capacity hopper Automatic. 2 H.P. Motor 220 V. 60 C. 3 Ph. Must be complete with accessories. Advise condition, location, age and price.
HARRY GOLDBERG & SONS
Perth Amboy, N. J.

WANTED
300—1000 H.P. Diesel engine.
NYLEN PRODUCTS COMPANY
St. Joseph, Michigan

At Your Service

The Searchlight Section is at your service for bringing business needs or "opportunities" to the attention of men associated in executive management, sales and responsible technical, engineering and operating capacities with the industry served by this publication. *See pages 372-390 this issue.*

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EXPLOSION-PROOF MOTOR
New or Rebuilt
One ¾, or one horsepower, or 1 ½ horsepower, D. C., 115 Volt, 1750 RPM.
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Graduate with ability to supervise maintenance of exciters, induction and synchronous motors, voltage regulators, switchboard equipment, combustion control instruments, etc., in 15,000 KW steam power plant, pumping station and compressor station. Essential War industry located near Asheville, N. C. Applicants please state age, education, previous experience and salary desired; photograph or snapshot not returnable.

American Enka Corporation
Enka, North Carolina

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Experienced in Steam and Electrical Power generation and industrial distribution. Capable of supervising, operating and maintaining departments, improving operating efficiency and planning for plant betterment.

Excellent opportunity to grow with a good substantial live wire manufacturing company, essential now, with post war plans made. To properly fill this position, applicant should be a technical graduate.

P-745, Power
520 N. Michigan Ave., Chicago 11, Ill.

WANTED

POWER PLANT ENGINEER

Excellent post-war opportunities with national manufacturer for graduate engineer with ten years' experience in design, construction and operation of industrial power plants. WMC regulations must be observed. Write details of experience, age, draft status and salary requirements.

P-735, Power, 330 W. 42nd St., N. Y. 18

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P-737, Power
330 West 42nd St., New York 18, N. Y.

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WANTED: A Mechanical engineer to take charge of designing and manufacturing slip-type or packed type expansion joints. Man required must have experience in this line. Not a duration job. Employees of this company have knowledge of this advertisement. Compensation commensurate with applicants abilities. Give details of experience. P-727, Power, 330 W. 42nd St., New York 18, N. Y.

WANTED—MECHANICAL engineer with good experience in modern power plant design to take charge of engineering department of mechanical contractor not engaged in or affected by war work. Should have experience in estimating power plant piping and layout work. Some construction experience and structural steel experience desirable but not absolutely necessary. Excellent opportunity for permanent position at good salary in well established business with advancement to execute position. Applicant should send preliminary information as to experience and salary to permit arrangement personal interview at companys expense. P-738, Power, 520 N. Michigan Ave., Chicago 11, Ill.

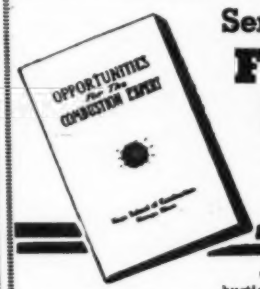
SHIFT OPERATOR—Steam. Permanent job. Must actually know turbines, condensers, boilers, etc., of modern H.P. types and be capable of operating a small switchboard. Minimum of high school education. No boozers or boomers wanted. Man (and/or wife) must be entirely willing to live in a very small country town and not expect war time wages. If you are fully qualified and can get proper clearance thru U.S.E.S. write, giving full particulars, care P-739, Power, 520 N. Michigan Ave., Chicago 11, Ill.

ENGINEER FOR permanent postwar program qualified to do estimating and assist sales department. Must have steam turbine experience. Excellent future for young man. Give qualifications, references and salary expected. Dean Hill Pump Co., 4006 E. 16th St., Indianapolis 7, Ind.

New England Representative

Established firm now handling centrifugal pumps and relief valves, desires companion line.

RA-734, Power
330 W. 42nd St., New York 18, N. Y.



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CENTRIFUGAL PUMP engineer, desires connection with a medium size progressive mfr. who wants a line of modern high efficiency medium sized centrifugal pumps from small close-coupled to large double section and multi-stage units. Over 28 years experience exclusively in this engineering field and at present a division Chief Engineer. Eastern location preferred. Tentative data and standards ready to work from, in laying out new lines quickly. PW-740, Power, 330 W. 42nd St., New York 18, N. Y.

POSITION AS chief engineer in preferably high pressure power plant. Ten (10) years experience with 150 #p.s.i. 5 years with 650 #p.s.i., which include 4 years supervising. Age 33 years. PW-741, Power, 520 N. Michigan Ave., Chicago 11. Ill.

ASSISTANT SALES manager, 15 years experience leading manufacturers design and sales diesels, turbines, pumps, compressors, other power plant equipment. Available due to recent change top management. Desire responsible sales connection with established firm only offering solid post-war position requiring broad engineering background. Release. PW-742, Power, 520 N. Michigan Ave., Chicago 11, Ill.

PLANT SUPERVISING and operating engineer wishes post-war position. To take charge of entire maintenance department and power plant. Married, age 40, 17 years experience. Highest references. Location no object. PW-744, Power, 330 W. 42nd St., New York 18, N. Y.

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MANUFACTURERS AGENT — Philadelphia office, covering Eatsern Pennsylvania, Southern New Jersey, and Delaware—contacts with mills, mines, railroads, chemical plants, refineries, and machinery manufacturers. Manufacturers desiring sales engineering representation please contact. RA-743, Power, 330 W. 42nd St., New York 18, N. Y.

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Are You Represented in New England?

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RA-723, Power
330 West 42nd St., New York 18, N. Y.

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(Wanted Advertising—see page 371)

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1—750 KW, 250 volt, Allis Chalmers, synchronous.
1—75 KW, 125 volt, General Electric, squirrel cage.
1—20 KW, 600 volt, General Electric, squirrel cage induction motor.
2—15 KW, 250 volt, General Electric, squirrel cage.
1—6½ KW, 125 volt, General Electric, squirrel cage.

ALTERNATORS

1—625 KVA, 3600 RPM, 600 volt, G.E.
1—250 KVA, 720 RPM, 230 volt, G.E.
1—200 KVA, 3600 RPM, 240 volt, Allis Chal.
1—62½ KVA, 3600 RPM, 220 volt, Allis Chal.

MOTORS—3 PHASE 60 CYCLE

1—500 HP, 900 RPM, Lincoln, 440 volt, slip ring.
1—350 HP, 300 RPM, 440 volt, General Electric slip ring.
1—300 HP, 720 RPM, 2200 volt, G.E., slip ring.
1—250 HP, 600 RPM, 4000 volt, G.E., syn.
1—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
1—150 HP, 1800 RPM, 440 volts, General Electric, squirrel cage.
1—150 HP, 1750 RPM, Westinghouse, sl. rg.
2—150 HP, 1200 RPM, 2200 volt Westinghouse, squirrel cage.
1—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
1—150 HP, 600 RPM, 220 volt General Electric, synchronous.
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3—100 HP, 720 RPM, 440 volt, G.E., sl. rg.
1—125 HP, 720 RPM, Allis Chalmers, sl. rg.
1—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
1—100 HP, 600 RPM, 440 volt, G.E., sl. cg.
1—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
2—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
1—90 HP, 400 RPM, 550 volt, Cr. Whlr. sq. cg.
1—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
1—75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
1—75 HP, 900 RPM, 440 volt, G.E., sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse., slip ring.
1—75 HP, 720 RPM, 440 volt, G.E., sq. cg.
2—75 HP, 1200 RPM, 2200 volt, G.E., Vertical.
1—50 HP, 900 RPM, 440 volt, G.E., sl. rg.
1—50 HP, 900 RPM, 440 volt, G.E., sq. cg.

SPECIAL

1—1000 Gallon GPM Worthington fire pump with 100 HP, 440 volt General Electric motor.

MOTORS—D.C. 230 VOLTS

2—450 HP, G.E., 400 RPM, Type MPL Form 1-F.
1—250 HP, 760 RPM, Electro Dynamic.
2—150 HP, Westghse., 550 RPM, Type SK.
1—150 HP, 750 RPM, Electro Dynamic.
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—80 HP, Crocker-Wheeler, 600 RPM, Type CMC.
1—75 HP, G.E., 575 RPM, Type C, Sprague; with spare armature.
1—65 HP, 1000 RPM, G.E., Type RC.
8—50 HP, Crocker-Wheeler, 700 RPM, Type CM.
1—65 HP, G.E. 625 RPM Type DLC—65, Form A.
1—50 HP, 750 RPM, Westghse., Type SK.
1—50 HP, 700 RPM, Crocker-Wheeler.
1—40 HP, G.E.-Sprague, 700 RPM, Type LC.
1—40 HP, 775 RPM, Westinghouse.
1—40 HP, 300 RPM, G.E.
1—30 HP, 750 RPM, G.E., Type RC.
1—30 HP, G.E., 750 RPM, Type RC-14, Form A.
1—30 HP, G.E., 1100 RPM, Type RC-31B, Form A-21.
1—25 HP, G.E., 650 RPM, Type RC-15.
1—30 HP, G.E., 625 RPM, Type C.
1—25 HP, Westghse., 600 RPM, Type SK.
2—25 HP, G.E., 775 RPM, Type RC-13.
1—20 HP, G.E., 800 RPM, Type RC-13, Form A.
1—15 HP, G.E., 800 RPM, Type RC-11.

TRANSFORMERS

2—400 KVA, G.E., 4156-250/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
3—200 KVA, Allis-Chalmers, 2200-220/110.
3—150 KVA, G.E., 33,000/2300/4000 Y.
4—150 KVA, General Electric, 2200/220/440 volts.
3—100 KVA, Westinghouse, 11,430/250 volts.
3—100 KVA, Westinghouse, 13200-250 volts.
3—100 KVA Allis-Chalmers, 2200/220/110 volts.
3—75 KVA, G.E., 13,500-750/440 volts.
3—75 KVA, General Electric, 2200/220/110.
1—75 KVA, G.E., 3 phase, 4156Y—120/208Y.
3—50 KVA, G.E., 2200/220/110.
2—50 KVA, Pbgh, 7500/15000 volts-110/220 volts.
3—37½ KVA, G.E., 2200/220/440.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

1—90 HP, 470/940 RPM, General Electric.
1—75 HP, 525/1575 RPM, Electro Dynamic.
1—35 HP, 350/1050 RPM, Electro Dynamic.
1—30 HP, 225/900 RPM, Crocker Wheeler.
1—30 HP, 400/1200 RPM, General Electric.
7—25 HP, Westinghouse, 650/2200 RPM. Type SK-110L.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
3—11½ HP, 500/1500 RPM, Westinghouse.
1—10 HP, 400/1600 RPM, Westinghouse.
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

TURBO GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 430 volt, bleeder.
1—375 KVA, Westghse., non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 v., con.
1—200 KW, G.E., 3 ph., 60 cy., 220 v., cond.

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NEW JERSEY—UNION 3-2600

How the Policy of

BELYEA

Protects You—*the buyer*

(3) Someone once said—"It's the little things that count." The Belyea standards for RE-NU-BILT equipment assures that the small items get their portion of attention.

During its 36 years of rebuilding experience careful note has been made of all criticisms, always striving to raise its standards to a higher level.

Appearance and performance are the factors that count highest in minds of the buyers. Both of the points get full consideration in the rebuilding and testing standards of Belyea RE-NU-BILT equipment.

Remember this—you get a guarantee of successful operation with all Re-Nu-Bilt equipment.

(1) ANALYSIS OF YOUR PROBLEMS

(2) CONSERVATIVE RECOMMENDATIONS

(3) CONSISTENT STANDARDS OF REBUILDING & TESTING

(4) TIME SAVING DELIVERY SCHEDULES

(5) REASONABLE PRICE POLICY

MOTOR GENERATOR SETS

3 phase—60 cycle

1—1500 KW, G.E. 275 v D.C. to 2100 HP, 2300 v syn.

1—1000 KW, Whse. 600 v D.C. to 1400 HP, 4000 v syn.

1—1000 KW, G.E. 275 v D.C. to 1400 HP, 2300 syn.

1—600 Kva, G.E. 330 KW, 220/440 v A.C. Gen. to 500 HP, 230 v D.C. motor

1—500 KW, G.E. 600 v D.C. to 700 HP, 13200/6600 syn. with exciter

1—500 KW, G.E. 275 v D.C. to 1000 Kva, 2300 v syn. with exciter

1—300 KW G.E. 275 v D.C. to 400 Kva 2300 v syn. with exciter

1—250 KW G.E. 275 v D.C. to 300 Kva 440 v syn.

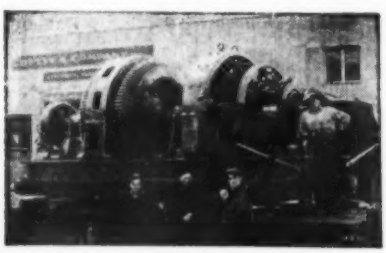
1—200 KW G.E. 125 v D.C. to 400 Kva 2300 v syn. with exciter

1—400 KW, G.E. 275 v D.C. to 700 HP, 2300 v syn. with exciter

1—75 KW, G.E 125 v D.C. to 120 HP, 2300/4000 v sq. cg.

1—50 KW, G.E., 125 v D.C. to 75 HP, 2300/4000 v sq. cg.

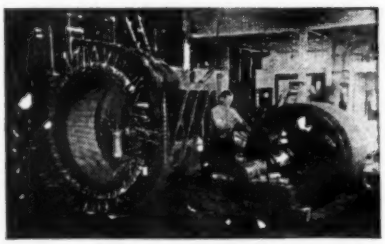
1—25 KW, G.E. 125 v D.C. to 40 HP, 220 v sq. cg.



FREQUENCY CHANGERS

1—75 KW, G.E., with 94 Kva .8 PF, 240 volt, type ATB, 3 phase, 62½ cycle gen. and 125 HP, 440 volt, 3 phase, 25 cycle motor

1—1000 KW, G.E., with 1250 Kva, .8 PF, AQB, 2300 volt, 2 phase (can be changed 800 KW, 3 phase), 58.3 cycle gen. and 1400 HP, .8 PF, 4400/2200 volt, ATI, 3 phase, 25 cycle motor and exciter



A C MOTORS

3 phase—60 cycle

SLIP RING

Qua.	Hp	Make	Type	Volts	Speed
1	1200	Cr. Wh.	801Q	2300	237
3	1000	Whse.	CW	2300	720
1	800	Al. Ch.	ANY	440	885
2	600	G.E.	IP	440/2200	720
1	600	G.E.	MT	550	220
1	450	Whse.	HF	2200	875
1	400	G.E.	IP	2200	252
1	400	Al. Ch.	ANY	2300	505
1	400	G.E.	IP	440/2200	600
1	350	G.E.	MT-442Y	2200/4000	353
1	300	G.E.	IM	440	900
1	300	G.E.	IM	440	720
1	300	Whse.	CW	440	585
1	250	G.E.	MT-424Y	4000	257
1	200	G.E.	IM	440	600
1	200	Whse.	CW	2200	514
1	150	G.E.	I-17B	2200	290
1	150	Whse.	CW-772C	2300	1160
1	150	G.E.	IM-16	2300	575
1	100	G.E.	IM	550	720
2	100	G.E.	IM	2200	575
1	100	G.E.	MTC	550	685
1	100	G.E.	IM	220	1750

SQUIRREL CAGE

Qua.	HP	Make	Type	Volts	Speed
1	300	Whse.	CS	550	580
1	300	G.E.	IK-17B	550/440	600
1	300	G.E.	IK-17	440	900
1	200	G.E.	IK	440	900
1	200	G.E.	IK-17B	2200	490
2	175/112	G.E.	IK-16	440	900/720
1	150	G.E.	IK	440	1200
1	125	Whse.	CS	550/220	1150
1	100	G.E.	KT	440	1800

ROTARY CONVERTERS

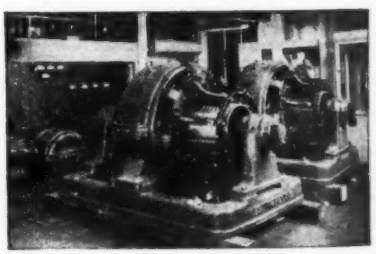
3 phase—60 cycle

Qua.	KW	Make	Speed	DCv	Trans V
1	1500	Whse.	720	600	2300
1	1500	Whse.	600	600	11500
1	1250	G.E.	720	260	2300
1	1000	G.E.	900	600	13200
1	1000	Whse.	900	600	11000
1	1000	Whse.	720	250	22000
2	750	G.E.	1200	600	2300
1	750	Whse.	720	250	6600/2300
1	500	Whse.	1200	600	13200/6600
2	375	G.E.	1200	250	6600/2300

3 phase—25 cycle—Booster Type

1	1500	G.E.	500	225/375	13200/6600
1	500	G.E.	750	225/275	13200/6600

All units can be furnished with AC and DC Panels.



D. C. MOTORS

Qua.	HP	Make	Type	Volts	Speed
2	1250	G.E.	MPC	500	130
1	1200	Whse.	Int.	600	600/720
1	1200	G.E.	MPC	600	450
1	800	G.E.	MPC	550	600
2	625	G.E.	MPC	500	130
1	500	Whse.	Int.	250	250/720
1	500	G.E.	MPC	230	900
2	300	G.E.	DMC	230	400/600
1	300	G.E.	MPC	230	275/550
1	250	Al. Ch.	Int.	230	525
1	175	Whse.	SK	250	150/525

RE-NU-BILT BELYEA MOTORS

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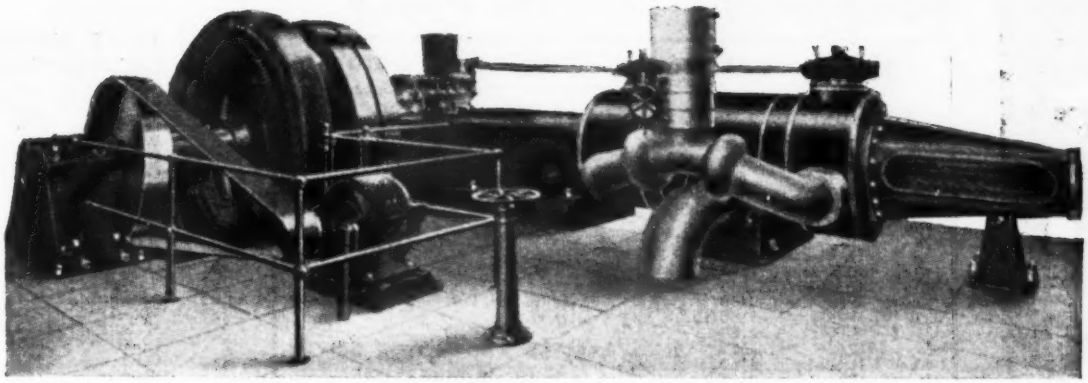
BELYEA COMPANY INC.

Main Office & Shop: 43 HOWELL ST., JERSEY CITY, N. J.

ELECTRICAL POWER MACHINERY



450 KVA UNIFLOW ENGINE GENERATOR SET

450 KVA General Electric generator, 3 phase 60 cycle 480/240 volts 150 RPM direct connected to Ames uniflow steam engine, 150 lbs. initial pressure, 5 lbs. back pressure, 150 RPM. Complete with auxiliaries.

ENGINE GENERATORS

3 phase 60 cycle

750 KVA WESTINGHOUSE - SKINNER uniflow, 150 lbs. 5 lbs. back pressure, 2300 volts.

250 KVA GENERAL ELECTRIC-SKINNER UNIFLOW, 150 lbs. 5 lbs. back pressure, 240 volts.

210 KVA GENERAL ELECTRIC engine type generator 2300 volts, 225 RPM.

125 KVA GENERAL ELECTRIC HARRISBURG corliss 125 lbs. 5 lbs. back pressure, 240/480 volts.

ENGINE GENERATORS

250 volts D.C.

500 KW CROCKER WHEELER AMES 4 cylinder vertical uniflow 150 lbs. 4 lbs. back pressure.

400 KW CROCKER WHEELER SKINNER uniflow 150 lbs. 5 lbs. back pressure.

TURBO GENERATOR 250 volts D.C.

500 KW GENERAL ELECTRIC automatic extraction 150 lbs. 0-28 lbs. extraction with surface condenser.

TURBO GENERATORS

3 phase 60 cycle

6250 KVA WESTINGHOUSE condensing, 200 lbs. 2300 volts with jet condenser.

3750 KVA GENERAL ELECTRIC condensing 200 lbs. 2300 volts with surface condenser.

1563 KVA ALLIS CHALMERS condensing 200 lbs. 480 volts. with surface condenser.

1250 KVA ALLIS CHALMERS condensing, 150 lbs. 2300 volts with jet condenser.

MOTOR GENERATORS

3 phase 60 cycle

1500 KW WESTINGHOUSE synchronous, 250 volts D.C., 6900/12000 volts A.C. 360 RPM.

1000 KW GENERAL ELECTRIC 3-UNIT synchronous, 125/250 volts D.C., 4000/2300 volts A.C., 720 RPM.

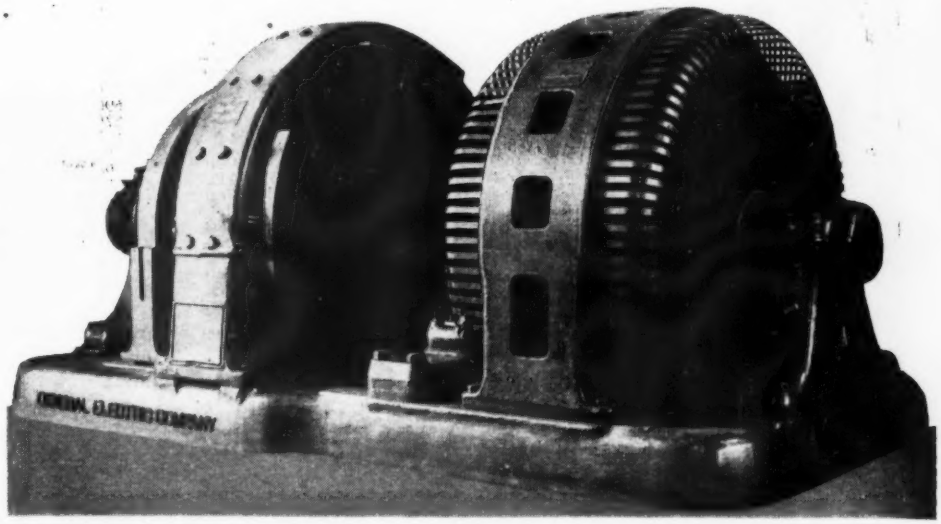
ROTARY CONVERTERS

3 phase 60 cycle

3500 KW WESTINGHOUSE 250 volts D.C., 225 RPM, with 13200 volt transformer.

2500 KW GENERAL ELECTRIC 250 volts D.C., 300 RPM with 4600 volt transformers.

750 KW GENERAL ELECTRIC 600 volts D.C., 1200 RPM with 2300/4000 volt transformers.



1000 KW Motor Generator Set

1000 KW (2) General Electric generators 250 volts, 720 RPM direct connected to 1400 HP General Electric synchronous motors, 3 phase 60 cycle 4150/2300 volts. *Complete with control. Can be shown in operation.*

THE NATIONAL POWER MACHINERY CO.
1921 SCRANTON ROAD
CLEVELAND, OHIO

L. J. LAND AND COMPANY

Dependable Electrical Equipment for War and for Peace time Production

DIRECT CURRENT

(Partial List Only)

230 VOLT DC MOTORS

H.P.	Make	Speed
60	El. Dynam.	900
60	Roth	600
60	G.E.	480/1100
50	West.	550/1100
50	Cr. Wh.	700 (2)
50	G.E.	850
45	Diehl	850/1020
40	El. Dy.	1200
40	Cr. Wh.	915
35	West.	1150
25	Diehl	850/1020
25	G.E.	1150
25	G.E.	575
20	R & M	1160
20	G.E.	1150
20	West.	1150
20	G.E.	800 (2)
15	West.	1250
15	G.E.	1150
15	Cr. Wh.	900/1800
15	West.	850
10	West.	850
10	G.E.	825
10	G.E.	700
10	Al. Ch.	600/1800
10	West.	600/1200
10	G.E.	400/1600
10	West.	400/1200
9	G.E.	450/1800
8½	Diehl	900
8½	West.	850
8½	West.	350/1400
7½	Sturt.	3600
7½	Peerl's	1700
7½	West.	1450
7½	West.	1150 (2)
7½	G.E.	1150
7½	West.	975
7½	Al. Ch.	850
7½	El. Dy.	550/1650
7½	Watson	525/1150
7½	G.E.	400/1600
7½	West.	400/1600
7½	Al. Ch.	350/1050
7½	G.E.	300/1200
6	G.E.	400/1200
6	G.E.	450/1800 (2)
5½	West.	500/1500 (2)
5	West.	850
5	G.E.	900 (2)
5½	G.E.	400/1600
5	West.	1800
5	G.E.	1700
5	G.E.	1150 (2)
5	West.	1100
5	Al. Ch.	1150
5	Cont.	600/1800
5	West.	850
5	G.E.	850
5	Star	600/1200
5	El. Dy.	550/1650
5	G.E.	450/800
5	G.E.	600
5	G.E.	450/1350
5	West.	400/1200
5	El. Dy.	275/1100
4	G.E.	850/1150
3½	West.	850/1600
3	West.	1700
3	West.	1150 (6)
3	Roth	500/2000
3	G.E.	500/1500
2½	West.	480/1800

236 additional 230 volt D. C. Motors in stock as small as 1/20 H.P.

115 VOLT DC MOTORS

H.P.	Make	Speed
90	G.E.	900
20	West.	200/900
15	West.	1100
15	Cr. Wh.	800
10	L. Allis	3500
10	West.	850
10	El. Dy.	425/1275
7½	G.E.	850 (2)
6	Burke	650
5	Cr. Wh.	1875
5	West.	1100 (2)
5	Cr. Wh.	960

75 additional 110 volt Motors down to 1/6 H.P.

BELTED AND MOTOR DRIVEN DC GENERATORS

100 KW West.	125 volts
100 KW West.	250 volts
75 KW West.	250 volts
60 KW Al. Ch.	250 volts
60 KW G.E.	600 volts
60 KW G.E.	125 volts
50 KW G.E.	250 volts
50 KW West.	125 volts
45 KW West.	250 volts
30 KW El. Dy.	600 volts
40 KW Cr. Wh.	125 volts
30 KW West.	125 volts
25 KW West.	125 volts
25 KW G.E.	250 volts
20 KW G.E.	125 volts
15 KW West.	125 volts

43 additional Motor Generator Sets, 30 volts, 60 volts, 125 volts, 250 volts, and 250 volts as small as ½ K.W.

ALTERNATING CURRENT

(Partial List Only)

2 & 3 PHASE SLIP RING

H.P.	Make	Speed
250	G.E.	600
125	Burke	580
112	G.E.	900
100	F. M.	690
75	West.	1170
75	Al Ch.	575
64	G.E.	585
60	West.	1135
60	West.	290
50	G.E.	870 (2)
50	West.	850
40	Wagner	1150
40	F. M.	870
40	West.	870
40	Linc.	690
30	G.E.	870
30	G.E.	690
15/35	West.	6/1200 (5)
25/55	G.E.	6/1200
20/50	West.	6/1200
25	Al. Ch.	870 (2)
25	West.	850
25	G.E.	870 (2)
25	G.E.	720
25	West.	575
20	G.E.	870
20	West.	575

116 additional Slip Ring Motors in stock down to ½ H.P.

3 PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
200	G.E.	600
150	G.E.	860
150	West.	715
100	G.E.	1200
100	G.E.(BTA)	375/750
75	West.	870
50	West.	1200
50	G.E.	900
40	G.E.	900
35	Wagner	850
30	U. S.	3450 Vert.
30	West.	1750
30	Al. Ch.	514
25	Wagner	1200
25	West.	1140
25	Diehl	865
25	G.E.	900
25	Wagner	720
20	G.E.	1750
20	G.E.	1200
20	Cr. Wh.	1200
20	Al. Ch.	900
20	Diehl	900
20	G.E.	720
20	West.	1720

29—15 H.P. 4 speed 600/900/1200/1800 RPM Constant H.P. Ball Bearing motors, West. and Louis Allis

15	Cr. Wh.	1700
15	G.E.	1200
15	Wagner	720
15	G.E.	600
10	G.E.	720
10	G.E.	3450
10	West.	1150

325 additional three phase Motors down to ¼ H.P.

TWO PHASE SQUIRREL CAGE MOTORS

H.P.	Make	Speed
50	Linc.	900
50	G.E.	900
40	G.E.	900
40	Al. Ch.	900
35	Al. Ch.	900
30	West.	1200
25	G.E.	1200
20	West.	1150
15	G.E.	1200
15	F & M	900
10	G.E.	1200
10	G.E.	900
7½	G.E.	900
7½	G.E.(BQS)	600/1350
5	G.E.	900
5	Al. Ch.	1200

146 additional two phase Motors down to ¼ H.P.

SINGLE PHASE MOTORS

H.P.	Make	Speed
20	Wagner	1160
20	Cont.	1165
7½	Cont.	3500

AC GENERATORS

150 KW G.E.	720
125 KW Cr. Wh.	900
100 KVA West.	600
60 KW G.E.	1200
25 KVA West.	1200

New York City's Largest Stock Electrical Machines

ESTABLISHED 1910

SOLD WITH A ONE-YEAR GUARANTEE

SPECIALS

1000 Ampere 60 Volt
CHANDEYSSON
Synchronous Motor Driven
D.C. GENERATOR
450 RPM—3 ph 60 cy 220 Volt
Complete with Starter & Panel Board

1000 ampere 6 Volt Plater
Chandeysson Synchronous Motor Driven
600 RPM 3/60/220V.

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Rebuilt and Sold with a Standard New Guarantee

ONLY PARTIAL LIST

TRANSFORMERS

1—200 KVA GE, type H.K. 2300/115/230 volts, 1 PH. 60 cy.
2—200 KVA GE, type H Form VD 4800/2400/480 volts, 1 PH. 25 cy.
3—150 KVA A.C., 4800/2400/120/240 volts, 1 PH. 60 cy.
2—150 KVA Pittsburgh, 2300/115/230 volts, 1 PH. 60 cy.
2— 75 KVA West. type S.K. 1 ph. 25 cy. 60000 volts Prim—6900/2300 volts secondary.

OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

250 K.W.—(312 KVA) Gen.-Elect., Type A.T.I.—2300/4600 volt, 60 cycle 150 R.P.M. P. F. .08 with separate belted exciter.
240 KW, 8 PF Electric Machinery, 4600 volts, 60 cycle 3 phase, 450 R.P.M. with direct connected exciter.
200 K.W. Westh. Unity Power Factor, 3 PH. 60 cyc. 220/440 900 R.P.M. with direct connected exciter.
150 KVA Westinghouse, 3 phase, 60 cycle, 2300 volts, 600 R.P.M. Revolving field with direct connected exciter.
150 KVA Gen. Elec. Type ATB form D, 60, 3 ph., 220/440 600 with Rev. Field. and built in Exc.

MOTOR GENERATOR SETS

Western Elect. 1000 Amps—40 volts direct con. to either AC or DC 580 RPM Motor.

CRANE MOTORS

75 H.P.—G. E. 51—230 Volts—550 RPM
35 H.P.—G. E. Form D—550 Volts—590 RPM

D. C. GENERATORS

150 KW Western Elec. 3 brg. 3 wire, 115/230 V. 600 R.P.M.
50 KW Gen. Elec. DLC—Comp. Ind. 125 V.—1150 R.P.M.

FREQUENCY CHANGERS

25 K.W. Gen. Elec. Type I.T.T. Frame 326—3 Ph 60/120 Cy. 440 volt Prim. 220 volt SPC. 1200 R.P.M. Dir. Con. to 25 HP. G. E. KT 326—3 Ph. 60 Cy. Motors.

ALL SIZES VOLTAGES AND CYCLES

3 ph. 25 cy. MOTORS

H.P.	Make	Type	Speed	Volts
350	Gen. Elec.	Sl. Rg. 3 Brg. I	375	440
200	Lincoln	S. R. I. X. W.	500	440
150	Gen. Elec.	Sl. Rg. I Form M	500	2200
100	Wagner	Sl. Rg. BR	750	220–440
100	Gen. Elec.	Sq. C. I K	750	220/440
75	Wagner	Sq. C. BM	750	2200

3 ph. 60 cy. A. C. MOTORS

H.P.	Make	Type	Speed	Volts
200	West.	Syn.-Dir. Con. Ex. P. F. .08	900	220/440
200	Gen. Elec.	Syn. ATI	514	4000/2300
200	Weghse.	Syn. Dir. Con. Exc.	600	2300
150	Burke	Sq. Cg. 3 BRG. 2 ph.	900	220/440
25	Gen. Elec.	Sq. Cg. I. K. Vert.	720	220

230 D. C. MOTORS

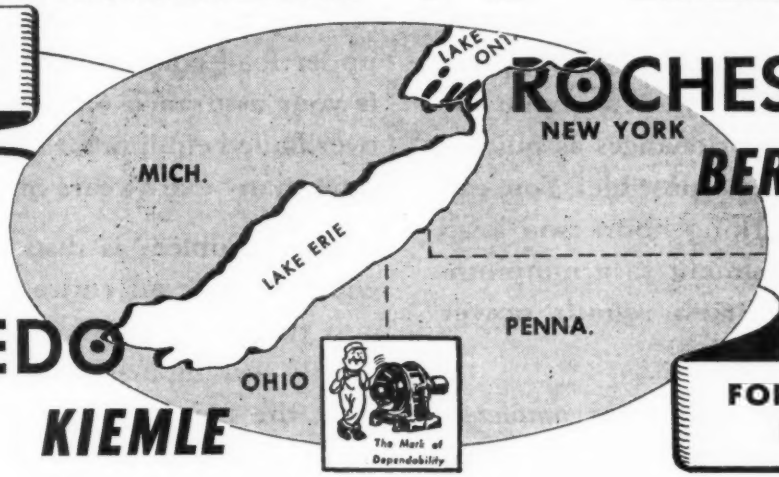
H.P	Make	Type	Speed
85	Gen. Elec.	Vert. Comp. Wound	700
75	Crocker Wh.	CCM25JA	1700
60	Sprague	D—Comp. Wound	625
50	Gen. Elec.	C. L. 6 Shunt Wound	500
40	Fair. Morse	Ball BRG. Vert. Comp.	1740
35	West.	SK 150—Shunt Int. 550 volts	850

OVER 10,000 STOCK ITEMS

THE FRED W. KIEMLE CO.
33 N. SUPERIOR ST.
TOLEDO 4 OHIO

in TOLEDO

KIEMLE



in ROCHESTER
NEW YORK

BERGER

BERGER BROTHERS ELECTRIC MOTORS, Inc.
395 STATE ST.
ROCHESTER 4
NEW YORK

FOR IMMEDIATE DELIVERY

TRANSFORMERS

3—500 KVA, GE, type H, form VD525 19100-22000/40000Y to 2300 1 phase 25 cycle.
1—350 KVA, GE, type H-K.D.D. 2300/460—1 PH. 60 Cy.
1—200 KVA Maloney type H.E. 2400/120/240 volts, 1 phase 60 cycle.
3—40 KVA West. SK. 1 Ph. 60 Cy. 6900 Volt Prim 2300 Volts Sec.

OTHER SIZES, VOLTAGE AND CYCLES AVAILABLE

ALTERNATORS

10 K.W. Gen. Elect. 1 Ph. 60 Cy. 220 Volts—1800 R.P.M.

D. C. GENERATORS

50 K.W. G.E. CL90—Comp. WD. 250 volts 1080 R.P.M.

MOTOR GENERATOR SETS

Gen.-Elect—100 KW. 3 brg. 125 volts D.C. Comp WD-Int. with 220/460 volts. Sq. Cg. Motor.

300 KW Gen. Elect. Synchronous Converter, 6 Phase, type HCC form J, 25 cycle 750 speed with transformers for 2300 volts to 230 volts D.C.

3 ph. 60 cy. A. C. MOTORS

H.P.	Make		Type	Speed	Volts
200	Weghse.	Sl. Rg.	CW	600	220/440
150	Gen. Elec.	Sq. Cg.	I.K.	600	2300/
100	Gen. Elec.	S. C.	K.T.	720	440
100	Gen. Elec.	S. C.	FTR	1150	440
100	Lincoln		M	1150	440
100	Gen. Elec.	SR	MT	600	440

3 ph. 25 cy. MOTORS

H.P.	Make		Type	Speed	Volts
150	Gen. Elec.	S. R.	1M	500	440
100	Allis Ch.	S. R.		750	440
75	Gen- Elec-	Var-	BTA	375/750	440
75	Gen. Elec.	S. R.	I. M. 17B	160	440
75	Gen. Elec.	Sl. Rg.	I M	750	220/440

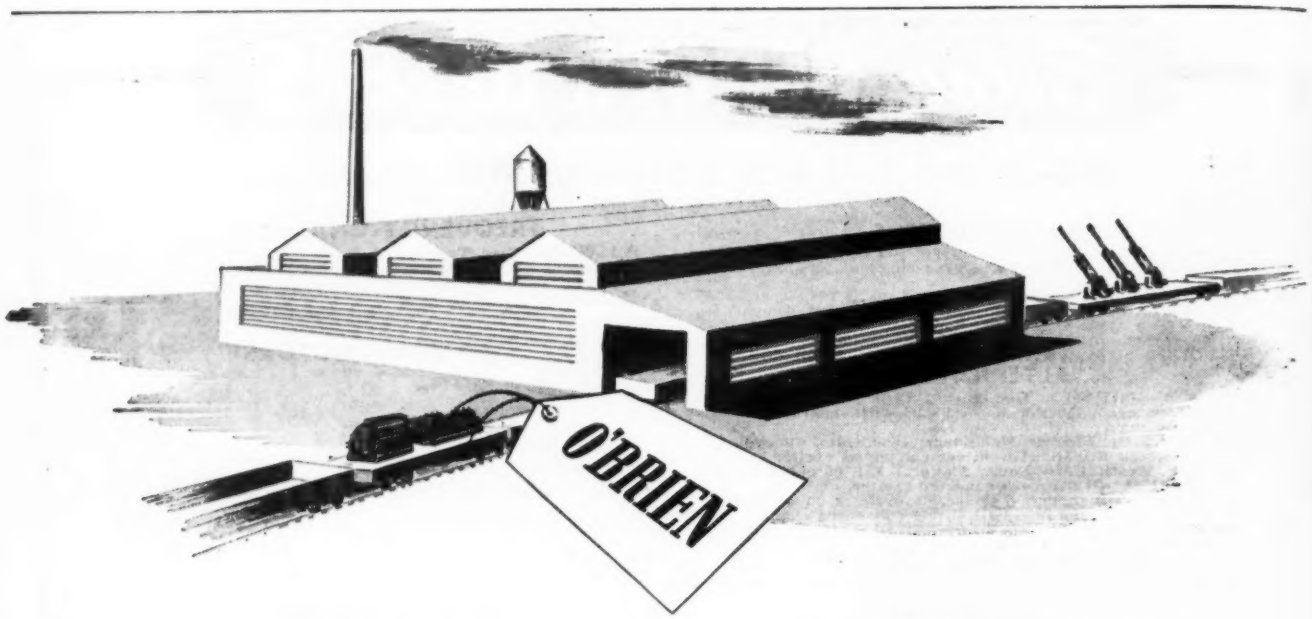
230 D. C. MOTORS

H.P.	Make	Type	Speed
150	West.	SK 180L Comp. Wd. Int.....	1150
100	Northwestern	K30 Comp. Inter.	1750
50	Crocker Wheeler	CM	625

Rebuilt and Sold with a Standard New Guarantee

Put all idle equipment to work. Send your list for prompt action. **WRITE OR WIRE YOUR INQUIRIES**

Above KIEMLE OFFERS



IF RECONVERSION CHANGES YOUR POWER NEEDS...

Whether the swing back to civilian production raises or lowers your power requirements, you'll want to make the necessary equipment changes as quickly and economically as possible. You can save precious working hours and keep your capital investment to a minimum by installing O'Brien *rebuilt* power plant equipment.

Rebuilt the O'Brien way means *completely* rebuilt, thoroughly tested and guaranteed. O'Brien facilities include extensive shops as well as steam and electrical testing facilities comparable to those of leading manufacturers. Exact testing under load conditions before shipment is your assurance of getting completely overhauled equipment into which we've built many extra years of useful life.

If your problem is disposal of surplus equipment or an entire plant, you can also turn to O'Brien. For we are constantly seeking machinery of all types to meet the growing demands of our customers. Remember, you can buy from or sell to O'Brien with the same degree of confidence. And O'Brien service is just as close as your telephone!

WE CARRY IN STOCK NEW—USED—GUARANTEED REBUILT POWER PLANT EQUIPMENT

Turbo Generators — Engine Generators — Diesel Engines — Boilers — Motor Generator Sets
Blowers — Electric Motors — Air Compressors — Pumps — Heaters — Complete Power Plants

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Everything from a Pulley to a Power House

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

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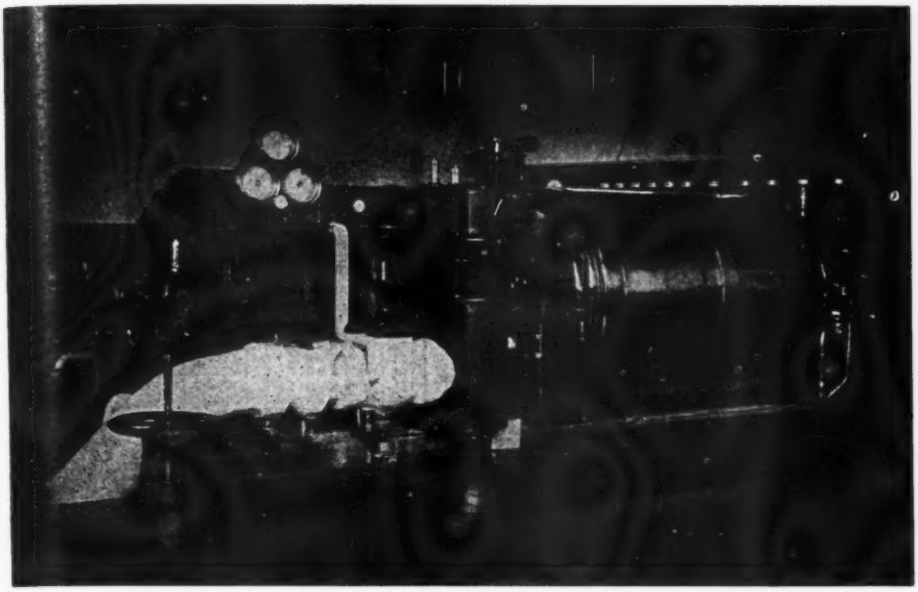
BELL TELEPHONE: MARKET 4180 CABLE ADDRESS: OBRIEN PHILA

3125 KVA CONDENSING TURBINE-GENERATOR UNIT



ACTUAL PHOTOGRAPH

AVAILABLE IMMEDIATE DELIVERY

3125 KVA — 2500 KW 80% P.F. General Electric, 3 phase, 60 cycle, 2300 volt, 3600 RPM condensing turbine-generator unit, 180-200# I.S.P. 500° T.T., equipped with surface condenser, panels and instruments.

Excellent condition—a complete installation.

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

1875 KVA G.E. condensing 175-200 lb. pressure, 500° T.T. 6600 volts, 3600 RPM complete with condenser.

750 KVA G.E. non-condensing, 175-200 lb. pressure, 15 lb. back pressure, 480 volts, 3600 RPM, complete with switchboard.

425 KVA G.E. condensing 200 lb. pressure, 2300 volts, 3600 RPM complete with condenser and auxiliaries.

375 KVA G.E. condensing 150-200 lb. pressure, 100° SH, 2300 volts, 3600 RPM complete with surface condenser and auxiliaries.

375 KVA G.E. non-condensing, 150-175 lb. pressure, 5 lb. back pressure, 2300 volts, 3600 RPM each complete with direct connected exciter.

125 KVA G.E. non-condensing, 110-125 lb. pressure, 0-10 lb. back pressure, 240 volts, 3600 RPM complete with switchboard.

ENGINE-GENERATOR UNITS

Direct Current

1000 KW Westinghouse, 250 volts, 514 RPM generator direct connected through reduction gear to Westinghouse condensing turbine, 150-200 lb. pressure, equipped surface condenser.

600 KW Crocker-Wheeler, 250 volts, 300 RPM generator direct connected to a 14" x 18" 4 cylinder Ames vertical Unaflow non-condensing engine, 150-175 lb. pressure, 5 lb. back pressure, complete with switchboard.

350 KW G.E. 250 volt, 175 RPM generator direct connected to a 28" x 28" Skinner Universal Unaflow non-condensing engine.

125 KW, 125 volt, 250 RPM generator direct connected to 18" x 16" Elliott engine, 100 lb. pressure, 10 lb. back pressure, complete with switchboard.

75 KW 125 volt, 1800 RPM Westinghouse direct current non-condensing turbine-generator unit.

75 KW, 125 volt, 2400 RPM Allis Chalmers-Terry noncond. turbine-gen. unit.

15 KW (3) Crocker-Wheeler, 125 volt, 410 RPM generators each direct connected to an American Blower vertical engine.

ENGINE-GENERATOR UNITS

3 phase, 60 cycle Alternating Current

500 KVA Westinghouse 480 volts, 164 RPM generator direct connected Skinner Unaflow non-condensing engine, 110 to 140 lbs. steam pressure, 5 lb. back pressure.

375 KVA G.E. 2300 volts, 150 RPM generator direct connected to a Chuse cross compound 4-valve non-releasing Corliss engine.

350 KVA (2) General Electric, 2300 volts reconnectable for either 550/480 or 240 volts, 200 RPM generators each direct connected to Skinner automatic engine.

312 KVA Elliot 4000 2300/550 or 240 volts, 180 RPM generator direct connected to a 17" x 24" Elliott Unaflow non-condensing engine, 175 lb. pressure, 6 lb. back pressure.

250 KVA Westinghouse, 2300 or 480 volts, 200 RPM generator direct connected Nordberg Unaflow engine.

150 KVA Allis 240 volt, 225 RPM generator direct connected Skinner Universal Unaflow engine.

MOTORS

—3 phase, 60 cycle

500 HP Westinghouse 2200 volt, 1750 RPM squirrel cage induction.

125 HP 80% P.F. Elec. Mchy. 440 volts, 400 RPM synchronous..

60 HP G.E. 220 volts, 900 RPM squirrel cage induction complete with starting compensator.

50 HP G.E. type I, form M, 2200 volts, 1200 RPM slip ring..

SYN. MOTORS

3 phase, 25 cycle

1700 HP G.E. 2300 volts, 300 RPM.

910 HP Westgh. 2300 volts, 300 RPM.

MOTOR GENERATOR SET

1500 KW Allis-Chalmers, 600 or 275 volt direct current generator direct connected to 2190 HP, 3 phase, 60 cycle, 4000/6600 volt, 300 RPM synchronous motor.

FREQUENCY CHANGER SET

750 KVA Westinghouse, 3 ph., 60-cy., 2300 v. alternating current generator dir. con. to 910 HP. 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

1200 KVA General Electric, 3 ph., 60 cy., 2400 v. alternating current generator dir. con. to 1700 HP, 3 ph., 25 cy., 2300 v., 300 RPM syn. motor.

SPECIAL OFFERINGS

1250 KVA G.E. 3 phase, 60 cycle, 2300/550/440 volts, 300 RPM alternating current generator.

500 KVA G.E. 3 phase, 60 cycle, 2300 volt, 450 RPM belted generator.

350 GPM, 720' head, 5 stage Allis-Chalmers centrifugal pump direct connected to 125 HP, 3 phase, 60 cycle, 2200 volt, 1750 RPM motor.

22" x 48" Nordberg Corliss belted type engine, 150 to 175 lb. pressure, 100 RPM.

MODERN SLIGHTLY USED BOILER

500 HP, 250 lb. pressure, A.S.M.E. code, bent tube, water tube boiler complete with stoker and auxiliaries. New 1938.

Utilities Electrical Machinery Corporation

600 NATIONAL CITY BANK BLDG.
CLEVELAND, OHIO

WIRE OR PHONE
LONG DISTANCE 422

THE PICK OF POWER EQUIPMENT

TURBO UNITS—60 Cy.

1—15300 KVA Westinghouse Cond.
1— 6250 KVA General Electric Cond.
1— 4000 KW General Electric Cond.
1— 4000 KVA Allis Chalmers Cond.
1— 3125 KVA General Electric Cond.
1— 3125 KVA Westinghouse Cond.
1— 2500 KVA Westinghouse Cond.
1— 1563 KVA General Electric Cond.
1— 1563 KVA Westinghouse Extrac.
1— 1250 KVA General Electric Cond.
1— 937 KVA General Electric Cond.
1— 750 KVA General Electric Cond.
1— 625 KVA General Electric Non-C.
1— 470 KVA Westinghouse Non-C.
1— 312 KVA Moore Non-Condensing
1— 250 KVA Westinghouse Non-C.
1— 125 KVA Westinghouse Non-C.
1— 107 KVA Westinghouse Non-C.

STEAM ENGINE UNITS—60 Cy.

1—1067 KVA Nordberg Uniflow
1— 375 KVA Nordberg Uniflow
1— 325 KVA Skinner Uniflow
1— 300 KVA Hamilton 4-valve
1— 210 KVA Skinner Uniflow
1— 150 KVA Skinner Uniflow
1— 94 KVA Ridgway 4-valve
1— 93.8KVA Skinner Uniflow

D.C. STEAM ENGINE UNITS

1—500 KW Ames Uniflow 250 V.
1—400 KW Ridgway 4-valve 275 V.
1—350 KW Ridgway 4-valve 250 V.
1—250 KW Ames Uniflow 250 V.
1—200 KW Skinner Uniflow 125 V.
1—150 KW Ridgeway 4-valve 125/250 V.
1—125 KW Ridgway 4-valve 250 V. 3-wire
1—100 KW Elliott 4-valve 250 V. 3-wire

OIL & GAS ENGINE UNITS—60 Cy.

1—625 HP Worthington, 240 V. gen.
1—610 HP Campbell, 2400 V. gen.
1—600 HP West. (gas), 480 V. gen.
1—520 HP Busch Sulzer, 2400 V. gen.
1—375 HP Worthington, 240 V. gen.
1—360 HP Anderson, 2300 V. gen.
1—360 HP Fair.-Morse, 2400 V. gen.
1—300 HP Worthington, 2300 V. gen.
1—283 HP Coop.-Bess., 230 V. gen.
1—175 HP Sterling (gas), 480 V. gen.
3—160 HP Coop.-Bess., 216 V. gen.
1—145 HP Superior, 220 V. gen.

SURFACE CONDENSERS

1—20,000 sq. ft. Worthington
1—12,000 sq. ft. Worthington
1— 5,000 sq. ft. Westinghouse
1— 4,100 sq. ft. Ross

WATER TUBE BOILERS

1—850 HP B. & W. 250-lb., Stoker
1—750 HP Edge Moor 200-lb.
2—612 HP Stirling 200-lb., Stokers
1—600 HP Union 250-lb., Stoker
2—560 HP Erie City 460-lb.
2—512 HP Stirling 205-lb.
1—335 HP B. & W. 200-lb.
2—300 HP Heine 200-lb.
2—300 HP B. & W. 160-lb.

A. C. GENERATORS

2—1500 KVA G. E. 25 cy. 2200 V. 750 RPM
2—1250 KVA G. E. 60 cy. 480 V. 750 RPM
1— 750 KVA G. E. 60 cy. 230-460 V. 300 RPM
1— 680 KVA G. E. 25 cy. 13200-4000 V. 300 RPM
1— 500 KVA G. E. 60 cy. 2300 V. 360 RPM
1— 360 KVA West. 60 cy. 240 V. 360 RPM
1— 94 KVA G. E. 60 cy. 2300 V. 600 RPM
1— 48 KW Elec. Mcy. 60 cy. 2400 V. 1200 RPM

SYNCHRONOUS MOTORS

2—1250 HP G. E. 25 cy. 2200 V. 750 RPM
2—1125 HP G. E. 60 cy. 480 V. 720 RPM
1— 850 HP G. E. 25 cy. 13200-4000 V. 300 RPM
1— 770 HP G. E. 60 cy. 230-460 V. 300 RPM
1— 620 HP G. E. 60 cy. 440 V. 164 RPM
1— 150 HP West. 60 cy. 2200 V. 600 RPM
1— 100 HP G. E. 60 cy. 2300 V. 240 RPM (Super)

INDUCTION MOTORS—60 Cy.

4—3500 HP G. E. slip ring 2300 V. 120 RPM
1—2500 HP G. E. slip ring 6600 V. 253 RPM
1—1500 HP G. E. slip ring 6600 V. 253 RPM
1—1000 HP G. E. sq. cage 2300 V. 509 RPM
1— 600 HP G. E. sq. cage 440 V. 900 RPM
2— 400 HP G. E. slip ring 3800 V. 1800 RPM
2— 300 HP G. E. sq. cage 440 V. 600 RPM
2— 250 HP G. E. sq. cage 2300/4000 V. 1200 RPM
3— 250 HP West slip ring 2300 V. 720 RPM

MOTOR GEN. SETS—60 Cy.

1—1500 KW Allis Chalmers 600 V. DC
1—1000 KW General Electric 600 V. DC
1—1000 KW Westinghouse 250 V. DC
1— 300 KW Westinghouse 600 V. DC
1— 75 KW General Electric 125 V. DC
1— 75 KW Westinghouse 250 V. DC

ROTARIES—60 Cy.

2—2600 KW General Electric 250 V.
2—2500 KW Westinghouse 250 V.
2—1700 KW General Electric 250 V.
1—1500 KW Westinghouse 250 V.
2—1000 KW Westinghouse 250 V.
2— 750 KW General Electric 600 V.
1— 750 KW Westinghouse 225/275 V.
1— 500 KW General Electric 250V.
1— 500 KW General Electric 600 V.

FREQUENCY CHANGERS

2—12500 KW G.E. 60/25 cy. 300 RPM
2— 5000 KVA West. 25/60 cy. 300 RPM
2— 3125 KVA West. 25/62½ cy. 750 RPM
1— 2500 KVA West 25/60 cy. 300 RPM
1— 1875 KVA G. E. 25/60 cy. 300 RPM
2— 1250 KVA G. E. 25/62½ cy. 750 RPM
1— 1250 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 25/60 cy. 300 RPM
1— 750 KVA G. E. 60/25 cy. 300 RPM

SYN. CONDENSERS—60 Cy.

1—5000 KVA West. 5000 V. 720 RPM
2—1250 KVA G. E. 480 V. 720 RPM
1— 750 KVA G. E. 230-460 V. 300 RPM
1— 500 KVA West 2200 V. 900 RPM

TRANSFORMERS—1 Ph. 60 Cy.

1—10000 KVA West. 120,000/66000-13200 V. 3 ph
3— 2500 KVA Pitts. 66000-25400/12700 V.
1— 1500 KVA Pitts. 66000-33000 V. 3 ph.
3— 1250 KVA G. E. 66000-13200 V.
3— 750 KVA Pitts. 66000/33000 V.
3— 200 KVA G. E. 66000-13200/22800 V.
3— 1667 KVA G. E. 44000-2300/4000 Y V.
3— 200 KVA G. E. 33000-2300/4000 Y V.
3— 150 KVA G. E. 33000-2300 V.
3— 75 KVA G. E. 33000-13200/11000 V.
1—15000 KVA Al. Ch. 27880-4560 V. 3 ph.
2—10000 KVA West. 26400-4580 V. 3 ph.
1— 6000 KVA West. 26400-2300 V. 3 ph.
2— 1000 KVA G.E. 23000/11500-575 V.
3— 833 KVA G. E. 22000-2303/4000 Y V.
3— 667 KVA Packard 23000-440 V.
3— 250 KVA G. E. 22000-11000 V.
1— 6000 KVA West. 132000-2300 V. 3 ph.
6— 1667 KVA Pitts. 13200-2300 V.
3— 1000 KVA G.E. 13200-2300 V.
3— 200 KVA G. E. 13200-2300 V.
3— 200 KVA G. E. 13200-480 V. Pyranol
7— 667 KVA Moloney 11000-2300 V.
3— 150 KVA Pitts. 11000-2400 V.
3— 100 KVA West. 11000-250/125 V.
3—1250 KVA G. E. 6600-550 V.

VOLTAGE REGULATORS
60 Cycle Induction

6—96 KVA 400 A. 2400 V. Gen. Elec.
1—72 KVA 300 A. 2400 V. Gen. Elec.
2—46 KVA 200 A. 2300 V. West
6—36 KVA 150 A. 2400 V. Gen. Elec.
6—24 KVA 100 A. 2400 V. Gen. Elec.

OIL CIRCUIT BREAKERS

1— 400 A. 73 KV G. E. FKO36 Outdoor
1— 400 A. 73 KV G. E. FHKO36 Outdoor
1— 800 A. 37 KV G. E. FHKO136 Outdoor
6— 400 A. 37 KV G. E. FHKO136 Outdoor
4— 400 A. 34.5 KV Condit D-16-A Outdoor
2—1000 A. 30 KV Kelman CB76 Outdoor
2— 400 A. 15 KV G. E. FHKO136 Outdoor
1—2000 A. 15 KV West. E6 Outdoor
1—1500 A. 15 KV West. E6 Outdoor
2—1500 A. 15 KV G.E. FK12 Outdoor
6—1200 A. 4.5 KV Condit D-12 Outdoor
2—1000 A. 4.5 KV Condit D-12 Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.

50 CHURCH STREET, NEW YORK CITY 7, NEW YORK

TURBO-GENERATORS

A FEW OF THE COMPLETE UNITS NOW IN OUR STOCK

1—6250—KVA. G.E. 3/60/2300V. 200#
1—3125—KVA GE 3/60/2300V. 200#
2—1875—KVA GE 3/60/2300V. 200#
1—1000—KW. DC. West. 3/60/250: 135/200#
1—1563—KVA. G.E. Non-Cond.
1—937—KVA GE Automatic Extraction 3/60/2300 V. 200 lbs.
2—937—KVA Allis-Chal. 3/60/2300:200#
1—250—KVA GE. Non-Cond. 3/60/480

Also Any Capacity or Type Desired.

WILMS, WEAVER & COMPANY

PENOBSCOT BLDG. DETROIT 26, MICHIGAN

REBUILT POWER EQUIPMENT

READY TO SHIP!

MOTOR GENERATOR SETS

1—150 kw. Cr. Wh. 220/440 v. 3 ph. 60 cy. 580 rpm. M.G. Set.

1—200 kw. West. 250 v. DC 1200 rpm. 2200 v. 3 ph. 60 cy. complete with AC and DC swb.; also automatic reclosing circuit breaker.

1—300 kw. West. 550 v. DC 1200 rpm. 2200 v. 3/60 complete with AC and DC swb; also automatic reclosing circuit breaker.

1—1000 kw. G.E. M.G. Set 2300 v. AC, v. DC, 720 rpm.

SLIPRING MOTORS—3 PH., 60 Cy.

H.P.	Make	Volts	R.P.M.	Type
5	G.E.	440	1200	MT
20	Westg.	220	1735	CW
40 to 50	Westg.	440	1150	CW
50	G.E.	220/440	1160/560	CM-7
50	Westg.	440	1150	CW636A
50	Westg.	440	1145	HF
50	Chandeys'n	220/440	1800	
50	Allis Chal.	220	490	
54	Allis Chal.	440	900	
62	West.	220/440	1135	CW
75	G.E.	440	1200	I-M
75	West.	220/440/2200	580/290	CW
100	West.	220/440	720	CW
150/75	West.	220/440/2200	580/290	CW
150	West.	2200	375	CW
150	West.	2300	490	CW
150	West.	220/440	490	CW
150	G.E.	220	375	I-8
185		2300	900	
260	Burke	440	600	EMV-65
300	G.E.	440	900	I
300		2300	720	
400	Westg.	2300	580	CW
400	Westg.	2200	435	CW-1214
1500	Westg.	2200	435	CW

ALTERNATING CURRENT MOTORS 3 ph. 60 cy.

H.P.	Make	Volts	R.P.M.	Type
25	West.	220/440/550	1200	CS
25	G.E.	220/440	580	KF
30	G.E.	440	1800	KT
30	Linc. Elec.	220	600	
30	Duquesne	440	600	
30	Triumph	220	525	TR-138
30	Allis Chal.	220/440	1200	
35	Lincoln	220	720	
40	Howell	220	900	SO
40	Linc. Elec.	220	900	
40	Westg.	440	900	C
40	G.E.	220/440	900	KF
40	G.E.	220/440	1160	K
40	Duquesne	220/440	850	
40	G.E.	440	1800	I-4
40	G.E.	440	1800	KT-527-4
50	Fair Morse	220	900	
50/150	West.	2200	360/720	CS-954
50	Western El.	220	570	KT-346
50	Chandeys.	220/440	1800	
50	Cr. Wh.	240/480	1200	Syn.
50	Duquesne	440	1200	
50	Allis Chal.	440	1800	AN
50	West.	440	1120	C
50	G.E.	220/440	1200	HI
50	G.E.	440	900	
50	Allis Chal.	2200	865	
50/32	G.E.	440	800/640	
60	Duquesne	440	1800	
75	Louis Allis	220/440	1770	505Y
	Adjusto speed—splash proof—ball bearing			
75	West.	2220/220/440	720	CS
75	West.	2300	1200	Syn.
100	Allis Chal.	220	1750	
100	Allis Chal.	220	600	
100	U. S.	220/440	1160	SC
100	G.E.	440	400	I-K
125	West.	2300	1170	CS
125	G.E.	440	450	I
125	G.E.	220/550	400	I
150	New Amer.	480	720	Syn.
150	West.	220/440	327	Syn.
150	Wagner	440	1800	31V
150	G.E.	440	514	I
150	G.E.	220/550	450	I
150	G.E.	550	575	I-K
150	G.E.	2200/220/440	450/243	
150	Westg.	2200	327	LC-Syn.
50/100	West.	2200/440/220	360/720	CS
(Complete with Niles Speed Reducer, ratio 10:1)				
175	G.E.	2200	600	I-12
200	Westg.	440	1700	CS
200	Westg.	2200	900	
200	G.E.	220/500	514	I
400	West.	2200/220/440	500	CS
500	G.E.	220/440	1170	KTP-567
1000	G.E.	2300	509	K
1500	G.E.	2200/220/440	225	ATI-Syn.
2000	G.E.	2200/220/440	240	TS-Syn.
3500/4000	West.	4000/23000	900	Syn.

VARIABLE SPEED MOTORS—230 VOLT D.C.

H.P.	Make	R.P.M.	Type
2½	Westg.	450/900	SK-36
2½	G.E.	500/1000	RLC
2½	Reliance	500/1000	14T
2¾	Westg.	900/1800	SK
3	Jantz-Liest	650/1950	BI-DC
3	Roth (Enclosed)	500/1000	RS
3½	West.	400/1600	SA
3½	Westg.	850/1700	
3½	Reliance	300/600	
5	Reliance	300/1800	21
7½	Westg.	450/900	80L
7½	Reliance	650/1300	550v.
7½	Westg.	1125/2905	SK-43
7½	West.	400/1600	SA
7½	West.	425/850	SK
10	Westg.	565/1130	S-6
10	G.E.	625/1250	LC
10	West.	400/1600	SA
10	Reliance	450/1800	
15	Louis Allis	1150/1750	NA
15	Reliance	500/1800	
15	West.	850/1700	SK-90
15	West.	675/1350	SK-100L
20	West.	900/1800	SK-100L
20	G.E.	270/540	
20	Westg.	750/1500	SK-110L
20	Westg.	750/1125	SK
30	G.E.	450/900	RLC
35	G.E.	375/1400	IC
50	G.E.	600/1200	500 v.
75	West.	475/950	SK-180
75	West.	400/650	SK-181
75/150	Reliance	940/1250	

TRANSFORMERS—1 ph. 60 cy.

No.	Kva.	Pri.	Sec.	Make
1	5	550	110	Pgh.
7	5	1100/2200	122/244	G.E.
4	5	1100/2200	122/244	West.
7	5	1040/2080	115/230	G.E.
3	5	2300	220/440	G.E.
2	5	2200	120/240	G.E.
20	7½	2200/1100	240/120	West.
60	7½	1100/2200	120/240	G.E.
19	7½	2200	240/120	G.E.
8	10	2200/1100	240/120	West.
6	10	2200	120/240	G.E.
2	10	1100/2200	120/240	G.E.
2	15	400/30000/50000		Amer.
1	25	1100/2200	120/240	G.E.
6	35	220	110	West.
3	37½	2200	440/220	West.
1	37½	2300	220/110	Wagner
3	50	2300/4600	230/115	G.E.
3	50	6600	575/440/220	G.E.
4	50	6600	550/440	Pgh
2	50	6600	550	Allis Chal.
6	73	2200/4000	220/110	West.
6	73	440	205	West.
1	75	2200	220	Burke.
3	100	6600	220/440/550	Pgh

INDUSTRIAL TRUCKS

1—Baker Tow Truck with batteries.

1—4000 lb. Yale Electric Industrial Truck, model K-22A.

HOISTS

1—3 ton Westinghouse Hoist with Westinghouse DC Motor, 1600 rpm.

INDUCTION MOTOR GENERATOR SETS

250 Volts Compound Wound, D. C.—3 Ph., 60 cy. Motors

KW	Make	RPM	AC volts
2	Crocker Wheeler	1750	220/440
3	Westinghouse	1150	220/440
5	Allis Chalmers	1150	220/440
7½	Allis Chalmers	1150	220/440
10	General Electric	1150	220/440
15	Westinghouse	1150	220/440
20	Westinghouse	1150	220/440
25	Westinghouse	1150	220/440/550
35	G.E.	1150	220/440
35	Westinghouse	850	220/440
40	West.	1150	220/440
75	Reliance	1150	220/440
100	Reliance	1150	220/440

D.C. CLARK CONTROLLER

1—250 HP Clark Vari-time magnetic controller 230 v. DC reversing, used for plugging service. Can also be used non-reversing.

A.C.GENERATORS

35 KW Crocker Wheeler 240/480 v. 3 ph. 60 cy. 1200 rpm.

62½ KW Westg. 3 ph. 60 cy. 240/440/2300 v. 1200 rpm.

125 KVA New American Electric 480 v. 720 rpm. type OG-56.

125 KVA West., 220/220/440 v. 3 ph., 60 cy., 327 rpm.

250 KW Al. Ch., 480 v., 150 rmp. 3 ph.

360 KVA West. 220 v., 3 ph., 60 cy., 360 rpm.

SPEED REDUCERS

1—1 HP. D. O. James, size 82, ratio 20:1.

1—1 Hp Boston Worm Reduction Unit, ratio 30:1.

1—36 HP Cleveland Model 150, size 900 AT, ratio 43:1.

1—40 HP W. A. Jones 480 rpm. ratio 9.143:1.

2—50 HP W. A. Jones 575 rpm. ratio 9.143:1.

3—50 HP Niles Bement Pond double reduction, ratio 10:1.

2—50/150 HP Niles Bement Pond double reduction, 35 rpm. low speed, 70 rpm. high speed, 360/720 rpm. ratio 10:1.

1—75 HP W. A. Jones 875 rpm. ratio 9.143:1.

2—75 HP Niles Double Reduction 350 rpm. ratio 10:1.

1—100 HP W. A. Jones 1150 rpm. ratio 9.143:1.

2—100 HP Niles double reduction 550 rpm. ratio 10:1.

1—125 HP Niles double reduction 600 rpm. ratio 10:1.

1—125 HP Nuttal, single reduction, ratio 1.6:1 450 rpm.

1—150 HP Nuttal, single reduction, ratio 1.6:1.

3—150 HP Niles double reduction 720 rpm. ratio 10:1.

1—175 HP Jones 1750 rpm, ratio 9.143:1.

2—180 HP Cleveland size 1000 AT ratio 9-2/5:1.

1—200 HP Falk, ratio 3:1.

2—200 HP Niles Bement Pond double reduction, 860 rpm. ratio 10:1.

1—225 HP Nuttal, ratio 1.6:1.

2—300 HP Niles Bement Pond double reduction, 1150 rpm. ratio 10:1.

1—300 HP Nuttal, ratio 1.6:1.

2—400 HP Niles Bement Pond double reduction, 1750 rpm. ratio 10:1.

1—400 HP Nuttal, ratio 1.6:1.

Large Stock—CIRCUIT BREAKERS—METERS — CURRENT AND POTENTIAL TRANSFORMERS—POTHEADS—RELAYS — METERS — SAFETY SWITCHES — DISCONNECT SWITCHES — U-RE-LITES — PULLEYS—REACTORS.

WRITE, WIRE OR PHONE YOUR ELECTRICAL REQUIREMENTS—SEND FOR STOCK LIST.

LIST YOUR IDLE EQUIPMENT WITH US.

DUQUESNE ELECTRIC & MFG. CO.

PITTSBURGH 6, PA.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY

Jackson, Miss.

FOR SALE — PULVERIZERS

2—Aero Foster Wheeler Size F 8000# Coke per hour each, with 50-H.P. Ty F.T. G.E. Motors 440-volt 60 cycle 95% New $3,750.00 each.

BEVIS MACHINERY COMPANY

885 S. Santa Fe Ave. Los Angeles 13 Cal.

DIESELS

2—480 H.P. DELAVERGNES

6 CYL. 15 x 18

TYPE V. G.—300 R.P.M.

DIRECT CONNECTED TO

2—300 KW. WEST. A.C.

ROBERT SCHOONMAKER

Port Washington, Long Island, N.Y.

Phone Roslyn 1220

COMPLETE POWER PLANT

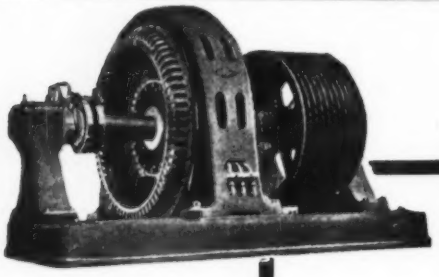
750 KW General Electric Turbo Generator, 3/60/480, direct connected Curtis Turbine, two 500 HP Sterling water tube boilers, stokers, coal handling equipment, superheaters, economizers, soot blowers, etc.

Plant housed in buildings fully intact.

Specifications on request.

MORSE BROS. MACHINERY CO.

P. O. Box 1708 Denver 1, Colorado

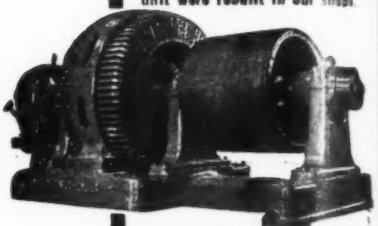


Single Motors Or
Complete Power Plants!

Synchronous motors, both large and small are available at Chicago Electric. This unit is typical of many rebuilt in our shops.

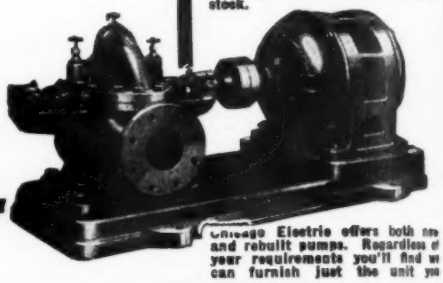
Chicago Electric specializes in the rebuilding of Motor Generator Sets . . . The above 750 KW Westinghouse set and a "twin" unit were rebuilt in our shops.

Specify Chicago Electric Rebuilt
POWER EQUIPMENT



The above 380 KVA Alternator was rebuilt by Chicago Electric for service in a large manufacturing plant . . . You'll find units of every type and size in our large stock.

Whether you need but a single motor—or require the rebuilding of a complete power plant, you'll find that Chicago Electric is able to furnish a service that will save you time and money. Investigate!



Chicago Electric offers both new and rebuilt pumps. Regardless of your requirements you'll find we can furnish just the unit you

CHICAGO ELECTRIC CO.
1320 W. 22nd St. Chicago 8, Illinois

POWER PLANT EQUIPMENT CO., Inc.

39 Cortlandt Street
New York, N. Y.

A C TURBINE UNITS

6250 KVA G.E., 2300 V., cond.
3750 KVA G.E., 2300 V. cond.
3125 KVA G.E., 4100/2300 V. cond.
3125 KVA G.E., 480 V., BLEEDER.
2500 KVA G.E., 2300 V. cond.
2500 KVA Al. Chal. 440 V. cond.
1875 KVA G.E., 2300 V. cond.
1250 KVA (2) G.E., 2300 V. cond.
940 KVA Wghse. 6600 V. cond.
937 KVA G.E., auto BLEEDER, 2300 V
937 KVA G.E., 2300 V. cond.
937 KVA Al. Chal. 2300 V. 300#.
780 KVA Al. Chal. 2300 V. cond.
750 KVA G.E., 2300 V. cond.
625 KVA Wghse. 2300 V. cond.
375 KVA G.E., 2300 V. cond.
312 KVA Elliott 480 v. cond.
250 KVA Al. Chal. 480 V. BLEEDER.
150 KVA Wghse. 240 V. cond.

(NON COND.)

500 KVA Wghse. 480/240 V.
375 KVA G.E., 2300 V.
312 KVA C.W.—Moore, 450#, 240 V.
125 KVA G.E., 480/240 V.
75 KVA Al. Chal. 240 V.

BOILERS

850 HP B&W W. T. Boiler 250# with Riley Stoker.
749 HP (2) Edgemoor, 200#
728 HP Erie City, Ver. 200#
612 HP Sterling 250# Chain Gr. Stoker.
522 HP Kidwell 207#, 3 drum.
471 HP Erie City Ver., 160#
396 HP B. & W., 160#
300 HP (2) Union Iron Wks. Cross drum 175#
287 HP (2) B&W 160#
259 HP (3) Wicks ver.; 160# pulverizers.
255 HP Casey-Hedges 160#
153 HP (2) Union I-Wks. 160# (stokers).
Two 78" x 18' HRT 125# pulverizers.

DIESEL ENGINE SETS

375 KVA Wghse.—Busch Sulzer
312 KVA G.E.—Anderson
312 KVA G.E.—McIntosh Sey.
200 KVA G.E.—Busch Sulzer.
125 KVA Ideal-Primm
105 KVA Ideal-Primm
100 KVA C.W. Bessemer
90 KVA (4) F.M.—F.M. "VA"
75 KVA Al. Chal.—International

DIESEL ENGINES

240 HP Fairbanks 35-E 6 cyl.
225 HP Chicago pneumatic 6 cyl.
80 HP (3) Fairbanks Style V. A.

SPECIAL

750 KVA G.E. 3-60-2300 V. turbo unit; surface condenser.
612 HP Sterling 250#; Cox Chain grate stoker.
522 Kidwell 207# with Fire-rite stoker.

STEAM ENGINE SETS (A C)

675 KVA Burke—24 x 36 Nordberg Unif.
375 KVA G.E.—22 x 27 Erie Ball, 4 V.
325 KVA A.C.—21 x 22 Skinner-Unif.
210 KVA G.E.—19 x 20 Skinner Unif.
150 KVA G.E.—16 x 15 Skinner Unif.
150 KVA G.E.—16 x 16 Skinner S.V.
100 KVA G.E.—14 x 15 Skinner Unif.
60 KVA G.E.—11 x 13 Skinner Unif.

PUMPS (MOTOR DRIVEN)

8000 GPM Al. Chal. 132' head.
7500 GPM 80' head
5500 GPM Buffalo 50' head
3600 GPM 85' head
3250 GPM 425' head
3000 GPM 100' head
3000 GPM (2) 65' head
1390 GPM 231' head
1200 GPM Al. Chal. 65' head
1000 GPM Morris 255' head
725 GPM Wheeler 30' head
350 GPM 720' head

STEAM ENGINE SETS (D C)

450 KW C. W. 250 V.—Nordberg Unif
400 KW G.E.—Ridgway 4 V.
300 KW G.E.—Skinner Unif.
150 KW G.E.—Erie Ball 4 V.
100 KW G.E.—Erie Ball 4 V.

AIR COMPRESSORS

2200 CFM Nordberg 100#, Steam and Motor Driven
1080 CFM Nordberg 85#—Motor
500 CFM Ingersoll 100#—Motor. "Steam and Gas Driven"; all sizes
250 CFM Worthington 80 to 100 lbs.—Motor

SYNCHRONOUS CONDENSER

5000 KVA Wghse. 3-60-2300/4000 V, 900 RPM, with starting apparatus.

GAS ENGINE UNIT

1000 KVA G.E. 3-60 2300 v.—1200 HP. Rathburn Jones Gas Engine.

SYNCH. CONVERTERS

500 KW G.E. 250 D.C. 2300/4000 A.C. 1200 RPM
600 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
500 KW AL-CH. 250 D.C. 2300/4000 A.C. 1200 RPM
500 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM
300 KW G.E. 600 D.C. 2300/4000 A.C. 1200 RPM
150 KW WEST. 250 D.C. 2300/4000 A.C. 1200 RPM

MOTOR GENERATORS

250 KW G.E. IND. 600 V. 2300/4000 A.C. 1200 RPM
200 KW RW SYN. 250 V. 2300/4000 A.C. 900 RPM

Each unit listed above is owned by us and is available now for immediate purchase.

WALLACE E. KIRK CO.
Incorporated
502 Grant Building Pittsburgh, Pa.

BOILERS

NEW and USED
All makes & sizes for prompt shipment

2—100 H. P. B. & W. Stirling Type Boilers 200#
2—100 H. P. Scotch Marine Boilers 100#
2—250 H. P. Scotch Marine Boilers 100#
1—275 K.V.A. Engine Generator Unit
13—Various sizes Vertical Fire Tube boilers
Feed Boiler Heaters

J. F. DAVIS CO.
122 S. Michigan Ave. CHICAGO

STEAM PUMPING ENGINES

1—Snow 8 MGD C&FW cr. Com. Opp. Type Cond. 36x44x17x36, with waterworks type condenser.
1—Snow 6 mgd. C&FW Cr. Com. Opp. Type Cond. 20-40x14½x36, with waterworks type cond.
1—Allis-Chal. 4 mgd. cr. com. cond. Size 13x18x13x24. All fine cond.

PUMP VALVES

Birch Valves for all types of reciprocating pumps.

LARGE GATE VALVES

1—20" Rensselaer #13 Iron Body Bronze Mounted Hub End Gate Valve with 16" Iron Brass Lined Hyd. Cyl. with indicating Rod and Eyebolt. 180#.
1—20" Crane 125# Flanged Hard Wheel operating Gate Valve.

BIRCH MANUFACTURING COMPANY
1523 Sedgwick St. Chicago, Ill.

CONDENSERS

1—1150 sq. ft. Worthington Surface Condensers. Admiralty tubes; with pumps

PUMPS—Large stock centrifugal—turbine—piston

STEAM PUMPS—Duplex-Simplex Reconditioned and guaranteed

BOILERS—stacks—Engine Generator

LOU COHEN & CO.
1030 N. 6th St. St. Louis 1, Mo.

1—400 HP Westinghouse, type CW, 3 ph. 60 cy. 440V. 450 RPM slip ring motor
1—300 HP General Electric, 3 phase, 60 cycle, 440 volt, 360 RPM, type MT 412 slip ring motor
1—275 HP, Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1175 RPM slip ring motor
1—200 HP, Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1150 RPM slip ring motor
1—150 HP, General Electric, 3-60-440V frames 17A 360 RPM slip ring
1—150 HP Westinghouse, 2 ph, 60 cy, 440V frame 1000, CW. 390 RPM slip ring
4—100 HP General Electric, 3-60-440V, 495 RPM, MT 562 slip ring
2—100 HP General Electric, type I, form K, 3-60-220V 575 RPM

2—800 HP, 3 PH, 60 CY, 6600 V Westinghouse, type CW, slip ring 507 RPM mill type motors with liquid slip regulators.

1—150 HP DC Westinghouse type SK, frame 666.3, 600 V. 360/720 RPM ped. type mill motor, #4798360.

1—100 HP Westinghouse, type CCL, 3 ph. 60 cy, 2200V, 1750 RPM, Squirrel Cage
1—100 HP Allis-Chalmers, type ANY, 3 ph, 60 cy, 220V, 580 RPM slip ring
1—100 HP General Electric, 3 ph, 60 cy, 4000V, 720 RPM syn., type TS with direct connected exciter
2—100 HP Crocker Wheeler, size 2AQ, 3 ph, 60 cy, 440V, 385 RPM slip ring
1—100 HP Westinghouse, type CS, 3 ph. 60 cy, 440V, 1750 RPM sq. cage
1—75 HP, General Electric, 3 phase, 60 cycle, 440 volt, 450 RPM, type I, form M, slip ring motor
1—75 HP Allis-Chalmers, 3 ph, 60 cy, 440V, 450 RPM slip ring
1—75 HP Fairbanks-Morse, type H, frame 165C, 3 ph, 60 cy, 550V, 900 RPM Squirrel Cage
1—75 HP Lincoln, type IQ, 2 ph, 60 cy. 440V, 600 RPM Squirrel Cage
1—75 HP Allis-Chalmers, 3 ph, 60 cy. 440V, 600 RPM slip ring
2—75 HP, Fairbanks-Morse, 3 phase, 60 cycle, 2200 volt, 1800 RPM, slip ring motors
1—60 HP Lincoln 3-60-220V frame IXM. Sq. Cage, 900 RPM
1—60 HP General Electric, 3-60-440V, 720 RPM, type I, form K
1—60 HP General Electric, 3-60-440V, 1750 RPM, type I slip ring
1—60 HP, General Electric, 3 phase, 60 cycle, 440 volt, 600 RPM, type MT 558 slip ring motor
1—50 HP General Electric 3-60-220V, 1150 RPM, type I, slip ring

2—G.E. factory built syn. M-G sets 230 KW, 125 V, 600 RPM generator driven by 335 HP, 4600 V syn. motor complete with starting equipment and panels.

1—50 HP Triumph 3-60-440V, type C12, 1150 RPM, slip ring, rotor & stator rewound
1—50 HP General Electric, 3-60-440V, 900 RPM, type I-M, slip ring
1—50 HP General Electric, 3-60-440V, 720 RPM, type IK, Sq. Cage
2—50 HP Allis-Chalmers, 3-60-440V, 690 RPM slip ring
1—50 KW, Allis-Chalmers, factory-built, 3 bearing M-G set, 125 volt DC, driven by 75 HP, 3 phase, 60 cycle, 220 volt, 1165 RPM motor
1—50 HP General Electric 3-60-440V, 690 RPM, MTS 46, slip ring
1—50 HP Ideal 3-60-440V, 580 RPM, type AV, slip ring
1—50 HP Wagner 3-60-440V, 495 RPM, type BM, Sq. Cage
1—50 HP Allis-Chalmers, 3-60-440V, 490 RPM, Sq. Cage
1—50 HP General Electric 3-60-440V, 490 RPM, type I-M, slip ring
1—50 HP Westinghouse CS 2-60-440V, 420 RPM, Sq. Cage
1—50 HP Allis-Chalmers, 3 ph, 60 cy, 550V, 860 RPM Sq. Cage
1—50 HP General Electric, type I-M, 3 ph. 60 cy, 440V, 720 RPM slip ring
1—45 KVA Fairbanks-Morse, 3 ph, 60 cy, 220V, 1200 RPM alternator
2—30 HP Fairbanks-Morse, 3 ph, 60 cy, 220V, 3600 RPM, type HO, frame 12B ball bearing

2—drag generators, 15 KW. Westinghouse, SK111, 125 V. 450/1800 RPM gear head, ratio 10 to 1, used a few months.

2—175 HP, 230V, DC Westinghouse, type SK, 150 to 550 RPM
1—100 HP General Electric, type CD, fr. 123, 230V, 1200 RPM
1—60 HP Westinghouse, type SK140L, 115V, 1150 RPM vertical
1—50 HP Westinghouse SK200, 230V, 250/900 RPM
2—40 HP, G. E., 3 ph, 60 cy, 440V, 435 RPM, type 1-13A

25 CYCLE MOTORS

1—50 HP Westinghouse 3-25 cy-440V, 720 RPM, type MS, Sq. Cage
1—50 HP General Electric, 3-25 cy-440V, 700 RPM, type I-M, slip ring
1—40 HP Westinghouse 3-25 cy-440V, 730 RPM, type CI, frame 753A slip ring crane
1—35 HP Allis-Chalmers 3-25 cy-440V, 720 RPM, slip ring
1—30 HP Westinghouse 3-25 cy 440V, 720 RPM, CS, Sq. Cage

The Wente Electric Co.

Hamilton, Ohio

REBUILT MOTORS & GENERATORS SINCE 1906

SLIP RING MOTORS

3-HP., 60-CY

HP	Volts	Make	Speed
900	2200	G.E.	900
500	2300	Whse.	514
450	2300	G.E.	600
400	2300	Whse.	1200
350	220–440	G.E.	1800
300	2200	G.E.	1800
300	2200	Whse.	514
250	2300	G.E.	600
250	440–550	G.E.	600
200	2200–550	G.E.	1800
200	2200–400	G.E.	600
150	440–220	G.E.	1800
150	440	G.E.	1800
150	550–2200	G.E.	1800
150	550	G.E.	720
125	440–220	G.E.	600
100	550–2200	G.E.	720
100	440–220	G.E.	1800
100	220–440	G.E.	720
100	220–440	G.E.	900
75	220–440	G.E.	900

SYNCHRONOUS MOTORS

3-HP., 60-CY

600	2200	Whse.	900
350	440–220	G.E.	900
300	440–220	Al. Ch.	600
200	2300–4000	G.E.	1200
110	440	Whse.	900
100	2200–550	Al. Ch.	1800
75	440–220	G.E.	720

PUMP

1—8" Dredge Pump 1880 GPM, 120' Morris Machine Works with direct connected Slip Ring Motor 125 HP, 600 RPM, G.E.

UNAFLOW ENGINE-GENERATOR SET consisting of:
Gen: 250 KW 200 RPM 250 volt direct connected to:
Eng: 23" x 24" Ames Unaflow 125/150# ga. non-condensing.
Very modern—practically new.

TRANSFORMERS

60 CYCLE

3—500 kva., G.E., type H, form KS, 13800-230/460
3—500 kva., Whse., 22000-2300.
3—350 kva., G.E., type H-KD 13200-4600.
3—333 kva., G.E., type H-KDD 2400-400/230.
3—250 kva., Whse., 13,800-460.
3—200 kva., G.E., type H 10000-600.
3—200 kva., G.E., H-KD 6600-2300/4000Y., 25 cy.
3—175 kva., G.E., 4000-480.
3—150 kva., G.E., type H-KDD 13200-2300.
3—150 kva., Al. Chal., type OISC 10400-2400.
1—100 kva., Pittsburgh, type OISC 2400-240-120.
3—100 kva., G.E., type H 2400-240-480.
3—100 kva., G.E., type H-KDD, 6900/11950Y-230/115.
3—100 kva., Whse., 22,000-2300.
2— 75 kva., G.E., type HK, 2300-230/115.
3— 50 kva., Moloney, 2300-230/115.
6— 50 kva., Whse., type SK, 13800-240/120.
3— 50 kva., Whse., 22,000-2300.

LARGE OIL CIRCUIT BREAKERS

1—New 400 Amp. Type FK, 136-1328A, General Elec. 3PST, 25,000 Volt Oil Switch, Interrupting Capacity 125,000 KVA, complete CT's PT's, etc.
1—3000 ampere, type FK 25, General Electric, 3 pst, 600 volt

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	1200
550	440/220	G.E.	IK	900
400	440	G.E.	KTP	1200
400	2200	Whse.	C.S.	1800
300	2200	G.E.	IE-K	1800
250	2200	G.E.	IK	600
250	2200	Whse.	CS	1200
250	440/220	G.E.	IK	1800
200	220/440	G.E.	IK	720
150	2200	Allis Ch.	AN	450
150	440/220	Whse.	CS	514
125	440/220	G.E.	KT	1800
100	2200	G.E.	IK	600
100	2200	G.E.	IE-K	1800
100	550	G.E.	KT	900
100	220/440	G.E.	KT	720
75	2200	G.E.	KT	900
75	2300	G.E.	IE-K	1800
60	550	G.E.	FT	3600
50	220/400	G.E.	K	1800

MOTOR GENERATOR SETS

2—150 kw, 125 v., 1200 rpm, Whse., conn. to 220 hp, 440/220 v., 3 ph., 60 cy., syn. very modern, practically new.
75 KW, 125 V. 1200 RPM Westinghouse Conn. to 112 H.P. 2300/440 V. 3 ph. 60 cy. ind. motor.
1—75 KW 250 V. 1800 RPM, Cr. Wh., Type CCD con. to 100 H.P., 2200 V., 3 ph., 60 cy. syn.

A.C. GENERATORS

1—500 kva., 900 r.p.m., 2209 V. Whse. Condenser.
1—300 kva., 900 r.p.m., 240/480 V., G.E.
1—225 kva., 600 r.p.m., 2200-240 V., G.E.
1—110 kva., 900 r.p.m., 440 V., G.E.
1— 60 kva., 720 r.p.m., 240/480 V., G.E.
1— 25 kva., 3600 r.p.m., 220 V., G.E.

STEPHEN HALL & CO.

HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

POWER PLANT EQUIPMENT

Turbo-Generators

1—4000 KW GE Cond. 2300 V.
1—3000 KW GE Cont. 600 V.
1—1250 KW West Cond. 440 V.
1— 750 KW West Cond. 6600 V.
1— 600 KW GE Cond. 600 V.
1— 500 KW GE Cond. 600 V.
1— 500 KW GE Cond. 125 V. DC.
1— 200 KW GE Cond. 2300 V.
1— 100 KW GE Cond. 600 V.
1— 75 KW GE N.C. 125 V. DC.

Turbines Only

1—210 HP Terry 250#
1—175 HP GE 110#
1—225 HP Terry with gears

Boilers

1—750 HP Heine 200# Stoker
3—318 HP Manning Type 170#
1—300 HP Heine 250# Stoker
1—150 HP HRT 150# Grates

Air Compressors

1—1214 CFM 100# Motor Driven
1— 600 CFM 500# Steam Driven
1— 368 CFM 100# Belted
1— 386 CFM I.R. Steam Driven

Centrifugal Compressors

10000 CFM 22# Turbine Driven

Pumps

2— 300 GPM 65' Hd. Motor Driven
1—1500 GPM Fire Pump Steam
1—1000 GPM Fire Pump Steam

Engine—Generators

1— 600 KW GE 2300 V.

Miscellaneous

1—4100 Sq. Ft. 2 Pass Surface Condenser
3—Sets of 78" Perfection Stokers for 84" HRT Boilers. New 1943

Also transformers, engines and cranes
Send us your inquiries

A. LEE ELLIS CO., U. S. Mchy. Bldg., Boston, Mass.

The Buyer Must Be Satisfied—Always

—TRANSFORMERS—

BOUGHT and SOLD

We have several thousand transformers in stock for prompt shipment, and invite your inquiries

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.

One Year Guarantee

THE ELECTRIC SERVICE CO., INC.

"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1913 CINCINNATI 37, OHIO

FOR SALE BY OWNER

Power Plant Equipment

● COMPLETE PLANT ●

2—150 H.P. H.R.T. Boilers ASME 1000 gal. motor driven Underwriters fire pump.
Boiler feed pumps.
44,000 square foot Nash Hytor Vatuum unit, complete with motor, receiver tanks, etc.
Feedwater heater—complete pipe & valve set-up.

BOILERS and STOKERS

4—500 H.P. 1—440 H.P. 1—524 H.P. Cross drum type B & W Boilers 200# Pressure.
1—183 H.P. 150# Bigelow Boiler.

● TURBO GENERATORS ●

1—500 KW G.E. 200# pressure 3 phase 60—2400/480/240 volts condensing. Exciter on shaft 15.6 KW per hour water rate-operating panels and pumps etc. 4 years use—high serial numbers. Other units up to 12500 KW. 1—2500—2—2000—1—1250 KW. 1—50 KW.

EXCELLENT EQUIPMENT

Transformers up to 5000 Kva.—3—2500 Kva.—9—300 Kva., 3—500 Kva. Number of smaller sizes.

Assortment of G.E. Flow Meters complete with boards, instruments.

Also have in stock oil circuit breakers up to 3,000 amps. and 74,000 volts—disconnect switches up to 6000 amps.

Stock of 5,000 current and potential transformers of all sizes, all kinds of relays, overload, underload, etc.

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Telephone Nos. Worth 2-2708—2709—2710

50 YEARS OF SERVICE

REQUEST FOR MODERN MACHINERY

750 KW to 5000 KW turbo generators—300 HP to 1000 HP Diesel engine generators—400 HP to 1000 HP 250# or better boilers.

We Solicit the Listing of your Idle Equipment for Resale

WORTHY USED POWER UNITS—WORTHWHILE BARGAINS

TURBOS

1—5000 KW Westinghouse 76 CW frame turbo generator 60/3/2300V/3600 rpm. Well maintained, heavy duty unit equal to new.
1—5000 KW G.E. Curtis 5 stage Cond. 60/3/2300V/3600 rpm, 175/200# 100° S.H. 28" Vac. complete. Also steel structure 35'6" x 64' x 27' high, 15 ton 33' crane.
1—4000 KW Wemco 60/3/2300V/3600 rpm Cond. 160# with all auxs.
1—2000 KW Wemco 60/3/460V turbo generator. 180# surface cond.
1—1250 KW Wemco turbo generator AC 60/3/150V 120° S.H. 3600 rpm. 480/500° T.T. BLEEDER 15,000# at 10-25# gauge.
1—1000 KW Wemco-Parsons low pressure low speed 125/150#/60/3/2300V/1800 rpm. complete. Surface condenser. Rolling Mill turbine.
1—750 KW Allis-Chalmers 60/3/2300V/3600 rpm. 300#, 550° T.T. with surface condenser, all auxiliaries. 1944 inspected.
1—940 KVA Wemco 60/3/2300V/6600 rpm. 250# 550° T.T. surface condenser.
1—750 KW Wemco 60/3/2300V maximum pressure 135# at 1800 rpm direct connected through 750 D.C. generator, surface condenser.
1—750 KW Allis-Chalmers 200# 60/3/2300V surface condenser direct connected exciter, complete.
1—300 KW Wemco 60/3/2400V 150# 5936 rpm, reductor, 900 rpm.

ALSO

2—300 HP, 1—500 HP Diesel engine generators.

STEAM ENGINE SETS

100-1000 HP.

BOILERS

1—100,000/120,000# steam generation plant, complete. Superheater Economizer, Steel encased boiler, with 14 retort underfeed stoker, 100,000# continuous.
4—1000 HP B&W Stirling type ASME code boiler, 200# with underfeed stokers.
1—750 HP 170# Edgemoor waste heat boiler, ASME code.
1—612 HP 200# 125° S.H. Stirling type boiler, ASME code.
2—684 HP 150# 125° waste heat boiler, ASME code.
3—522 HP 180# Heine boiler, 150° S.H. ASME code.
1—600 HP 170# Stirling boiler, complete with Riley pulverizers soot blowers.
1—444 HP Union Iron Works 200# 125° S.H. boiler, ASME code.
1—500 HP 170# 125° S.H. ASME code boiler, Combustion Eng. type E stoker.
2—400 HP Springfield boiler, 180# with stoker, ASME code.
3—386 HP Erie City Boiler, 175#, 125° S.H. complete.
2—365 HP Edgemoor 200# boiler, 100° S.H. ASME code ram type stoker.
3—316 HP Heine horizontal 170# waste heat boiler.
1—313 HP 250# Edgemoor boiler, 125° S.H. with stoker.

ALSO

Scotch Marine and HRT Boilers, 100 HP up.

MOTORS • GENERATORS • TRANSFORMERS

Prices on Application
Rebuilt Motors
3 PHASE, 60 Cycle, 220/440 Volts

HP	Make	Type	RPM
400	General Electric	I-K	900
400	General Electric	I-K	900
350	General Electric	I-K	900
250	General Electric	I-K	900
200	General Electric	KT357	1800
200	General Electric	KT357	1800
200	General Electric	KT357	1800
200	General Electric	KT357	1800
200	General Electric	I-K	900
200	General Electric	I-K	720
150	General Electric	KT357	1200
150	Westinghouse	CCL	900
125	General Electric	KT347	1800
100	General Electric	KT347	1200
100	General Electric	KT347	1200
100	General Electric	KT353	1200
75	General Electric	KT343	1800
75	General Electric	KT343	1800
60	General Electric	KT343	1200
60	Burke	EM7	870
60	General Electric	KT346	900
60	General Electric	KT346	900
50	Westinghouse	CS	1800
50	Westinghouse	CS	1800
50	Westinghouse	CS	1800
50	General Electric	KT327	1800
50	Westinghouse	CS-646A	870
50	Reliance	IJ	1800
40	Westinghouse	CS	1800
40	Westinghouse	CS	1800
40	General Electric	KT323	1800
40	General Electric	KT323	1800
40	General Electric	KT522	1800
40	Burke	EM45	1200
35	Lincoln	D-411	1800
30	Westinghouse	CCL	720
30	General Electric	KT332	1160
*30	Armor	A	850
25	General Electric	I	1150
**25	Westinghouse	CS-444	870
*20	Armor	ET-416	850
*20	Fairbanks Morse	H	900
*20	General Electric	KG-405	880
20	General Electric	KG-404	1150
20	General Electric	KT313	720
20	Fairbanks Morse	H-12A	850
15	Westinghouse	CS371C	1800
15	Westinghouse	CS371C	1800
15	Crocker Wheeler	1100	560
15	Crocker Wheeler	114Q	1800
10	Star	AX	3500
10	Century	SC	685
10	General Electric	K-404	700
10	General Electric	KT312	900
10	Lincoln		1200
7½	Fairbanks Morse	B	1200
7½	General Electric	KT	1200
7½	Wagner	14VBP	1800
5	Westinghouse	CCL	3400
3	U. S.	FRB	1800
3	Fairbanks Morse		900
*1	Master	PA	3425
1	Allis Chalmers	AR	1800

If You Use 25-CYCLE MOTORS
write for our
NEW LIST
from plants just purchased

Mine Slope Hoist

1—Connellsville Mfg. and Mine Supply Hoist storage capacity for 11,000 feet 1" Rope—Speed 900' per minute.
Motor 500 HP Gen. Elec. Mt. Silprins 3/60/2200/450 RPM. Complete with remote control. Herringbone reduction gears and demountable base and drum.

Write Wire Phone

SLIPRING MOTORS
60 Cycle—3 Phase—220/440 Volts

HP	Make	Type	RPM
500	Westinghouse	CW	575
400	General Electric	I-M	900
250	General Electric	I-M	900
250	Allis Chalmers		505
200	General Electric	I-M	900
75	General Electric	MT-546	900
50	Westinghouse	CW	700
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748A	690
40	Wagner	22WB	540
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748	690
40	Westinghouse	CW-748	690
30	Westinghouse	HF	1745
*20	Westinghouse	CW-644C	575
20	General Electric	MT-332	545
15	General Electric	I-M	900
15	General Electric	MT-322	855
13	Sachsenwerk	D7318	850
11	General Electric	ITC-5008	820
10	General Electric	MT-308Y	1800

* Ball bearing. ** Sealed sleeve bearing.

MOTORS
25 cycle—3 phase—2200 volts

100 H.P., General Electric, type KT568, 750 rpm, serial number 5227257, ball bearing.
100 H.P., Allis Chalmers, type AR, ball bearing, 1500 rpm, serial number 42209K426N-1-1.
150 H.P., General Electric, ball bearing, type KT557Y, 1500 rpm, serial number 5208756.

MOTOR GENERATOR SETS

1—125 KW Ridgeway 250 V. DC. 1200 RPM Motor 2/440/60/1200 Complete.
1—100 KW Westinghouse Synchronous-Generator 250-275 V. DC—Motor 3/60/2300/900 RPM complete with panels.

FREQUENCY CHANGER SET

1—1250 KVA Gen. Elec. Synchronous—motor 3/25/2200 750 RPM direct connected to Generator 362½/440 V. Complete with exciters and panels.

200 KW., 25 CYCLE, M. G. SET
200 KW. Gen. Elect. Generator, 240 V. DC. 750 RPM. Type MPC. on Factory Base direct connected to 300 HP. Gen. Elect. Type I Form K. 3/25/440 V. 750 RPM. Complete with Motor Starting Equipment and DC. Panels.

ERIE ELECTRIC CO., INC.

124 CHURCH ST. BUFFALO, N. Y. CL. 4758

PARTIAL LIST OF OUR COMPLETE STOCK FOR IMMEDIATE SHIPMENT

PUMPS

G.P.M.	Head	Make	Type
9700	110'	Ing. Rand	Centrif
6000	33'	LeCourtenay	Centrif
3500	140'	Kingsford	Centrif
2500	150'	Goulds	Centrif
2400	55'	American	Centrif
1100	220'	Allis-Chalm.	Centrif
1500	180'	Penna	Centrif
400	625'	LeCourtenay	Centrif
250	525'	LeCourtenay	Centrif
400	350'	Goulds	Triplex
300	500'	Goulds	Triplex
175	500'	Goulds	Triplex
500	175'	Blackmer	Rotary
450	231'	Kinney	Rotary
300	150'	Viking	Rotary
200	175'	Blackmer	Rotary
1000	460'	Knowles	Steam
750	460'	Snow	Steam
2000	50'	Lawrence	Sump
300	231'	Gardner	Plunger

M.G. SETS BOILER FEED PUMPS

K.W.	Make	Volts	Type
25	Geen Eng.	220	Belt Drive
100	Ames	240	dir. dr. Eng.
75	Ames	240/120	dir. dr. Eng.
17	Sturt Turb	110	Direct Drive
7½	Sturt. Turb	110	Direct Drive

MOTORS (D. C.)

100 Northwest 220 1750
25 Roth 230 1750

STORAGE TANKS

5 to 1000 Gal. Steel Press.
15 to 300 Gal. Conden. Tanks

CONDENSATION RETURN UNITS

Nash-Jenn Dup. Vac. Heat. 26000EDR
Nash-Jenn Simp. Vac. Heat. 16000EDR
Condensation Units 100 to 250,000EDR

AIR COMPRESSORS

C.F.M.	Pressure	Make	Type
850	100	Laidlaw	Hor. Dup
500	60	Ind. Rand	Steam
400	125	American	Horiz
350	40	Worthing	Horiz.
250	100	Sullivan	Horiz.
220	100	Gardner	Gas Eng
173	100	Ing. Rand	Horiz.
28	5000	Norwalk	4-Stage

TURBO-CENTRIFUGAL BLOWERS

3000	16 lbs.	In. Rand	Motor dr
3000	8 lbs.	In. Rand	Motor dr.
950	24 oz.	Spencer	Motor dr.
900	5¼ lbs.	In. Rand	Motor dr
700	2½ lbs.	Allen Billmyer	Motor dr.
675	24 oz.	Spencer	Motor dr.
250	16 oz.	Spencer	Motor dr.

BLOWERS

C.F.M.	St. Pres.	Make	Type
100–60000	¼"–5"	Buffalo	Various
100–15000	¼"–16 oz.	American	Various

ROTARY PRESSURE BLOWERS

C.F.M.	Press	Make	Type
10000	2 lbs.	Roots	Belt dr
6000	3 lbs.	Roots	Belt dr
3000	3 lbs.	Roots	Belt dr
2000	3 lbs.	Sturt.	Belt dr
1000	3 lbs.	Roots	Belt dr.
200	5 lbs.	Baker	Direct dr
110	15 lbs.	Beach R.	Belt dr

VACUUM PUMPS

1000	15 in.	Roots	Belt dr
350	27 in.	Worth	Belt dr
100	high vac	Beach R.	Gear dr
100	27 in.	Deane	Belt dr
100	29 in.	Devine	Belt dr

MOTORS (3 ph. 60 cy.)

H.P.	Make	Volts	Speed	Type
300	G.E.	2300/4000	1800	Syn
150	West.	440	700	CS
125	G.E.	220	1150	Vertical
100	Lincoln	220	1750	"
60	West.	220	1750	Cs
50	G.E.	2300	1750	I
50	West.	220	850	CCI
50	West.	220	570	CS
40	G.E.	220	870	342
30	G.E.	220	1750	312
30	Wagner	220	850	el. ra
30	Wagner	220	1150	

STEAM ENGINES

Turb. Cent. Bronze Pumps
Steam Pumps—All Sizes
10"x10" Greenfield Vertical
7"x7" Wickes Bros. Vertical
6"x6" Vertical & Smaller
1 to 40 H.P. Steam Turbines

SIMILAR EQUIPMENT IN STANDARD MAKES AND SMALLER SIZES
HIGHEST PRICES PAID FOR YOUR IDLE EQUIPMENT

SUPERIOR EQUIPMENT CO.
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Motor Generator Sets—Synchronous Motors, Etc.

M-G SETS

1—West. 500 KW 275 or 600 Volt D.C. 720 RPM. 2300 Volt 80% P.F. 720 HP A.C.

VERTICAL MOTORS

1—Reliance fan-cooled 25 HP 1750 RPM 220/440 Volt

SYNCHRONOUS MOTORS
3 phase, 60 cycle, A.C.

1—Burke 300 HP 900 RPM 440/220 Volt
1—Ideal 50 HP 600 RPM 2300 Volt

SLIP RING MOTORS, 3 phase, 60 cycle

Allis-Chalmers 250 HP 600 RPM 440 Volt

G.E. 62½ HP 1150 RPM 440/220 Volt

D. C. EQUIPMENT

20—Clark Bulletin 5370 30 HP 230 Volt D.C. automatic starters—none used over two months.

A large number of adjustable speed D.C. motors from 5 to 150 HP

ALTERNATORS SPECIAL, Allis-Chalmers, 125 KVA 277 RPM 3 Phase, 60 cycle

The Electric Motor & Repair Co., Cuyahoga Falls, O.

NORDBERG UNIFLOW ENGINE
and
ALLIS-CHALMERS GENERATOR

Nordberg type 'S' poppet valve Uniflow Engine Duplex, cylinder sizes 22"x22"x36", 150 R.P.M., 200# steam pressure. Direct connected to Allis-Chalmers 850 K. W. Generator, 220 volt, 3 phase, 60 cycles. Exciter. Switchboards.

EXCELLENT CONDITION

DENNY & CLARK
910 N. Marshfield Ave., Chicago, 22, Ill.

SWITCHES

1—3000 amp 3 pole 600 volt type FK25 General Electric
2—400 amp 3 pole outdoor type FHKO136 General Electric
1—800 amp 3 pole type B20 outdoor with house
10—1200 amp 3 pole FK32B General Electric

The above are just a few of the thousands of items we have in Motors, Generators, Turbo Generators, Engine Generators, Motor Generators, Transformers, Circuit Breakers, etc. Please send us your inquiries. What have you for sale?

KEYSTONE POWER PLANT EQUIPMENT COMPANY
8403 Hegerman St. Phila. 36, Penna.

FOR SALE

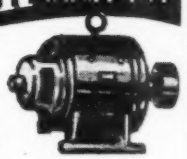
1—450 HP 6-cylinder 4-cycle 240 RPM full Diesel Engine direct-connected to a 375 KVA Westinghouse 3 phase 60 cycle Generator with direct-connected Exciter, Switchboard & Regulator, Circulating Pumps, Maxim Silencer, etc., etc.

2—110 HP Atlas 4-cylinder 360 RPM Diesel Power Units

1—110 HP Washington Iron Works 4-cylinder 600 RPM 4-cycle Diesel Engine.

SUNDFELT EQUIPMENT CO.
3422 First Ave. South,
Seattle 4, Wash.

POWER EQUIPMENT COMPANY



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AIR-OIL CIRCUIT BREAKERS
NEW REBUILT

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Telephone MAIN 568 or 569

DIESEL ENGINES FOR SALE

1—200 H.P. Cooper-Bessemer Full Diesel Solid Injection, 6 Cyl., 4 Cy., 325 RPM., bore 11" x 16" stroke.

2—55 H.P. Fairbanks-Morse Model 32D, Y.V.A., 1 Cyl., 360 RPM, clutch and outboard bearings.

ALJON ELECTRIC DIESEL CO.
151-55 Washington St. Brooklyn 1, N. Y.
Main 4-3804

DIESELS

2—150 H.P.
A.C. GENERATOR SETS
DIRECT CONNECTED TO
MODEL "E" BUCKEYES
400 R.P.M.

ROBERT SCHOONMAKER
Port Washington, Long Island, N.Y
Phone Roslyn 1220

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New or used. All types and sizes. Air and oil cooled. Phase changers a specialty.

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Transformer Specialists
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We Sell, Buy, Repair & Calibrate

Switchboard and Portable type A.C. & D.C. all types electric meters. Ship to us any meters you have for repairs via freight or express. We shall gladly submit estimate.

Philadelphia Transformer Co.
2829 Cedar St. Phila., Penna.

COMPRESSORS

Over 150 *In* stock

New and Guaranteed Rebuilt
Modern Plant doing Modern Rebuilding
From 50 CFM to 2500 CFM

AMERICAN AIR COMPRESSOR CORP.
Dell Ave. & 48th St., North Bergen, N. J.

ELECTRICAL EQUIPMENT — PROMPT SHIPMENT

SLIP RING MOTORS—3 ph. 60 cy.

HP	Make	Volts	RPM	Type
1500	Westgh.	2200	435	CW
500	G.E.	2200	435	MT 412
300	Westgh.	2200	495	CW
200	G.E.	2200	495	IM
200	G.E.	2200	240	MT 412
2–150/75	Westgh.	220/440/2200	590/290	CW
150	Westgh.	220/440/2200	590	CW
125	Al. Ch.	2200	435	ANY
150	Westgh.	220/440/2200	375	CW
100	Westgh.	220/440/2200	690	CW
100	Al. Ch.	220/440	575	ANY
75	Westgh.	220/440/2200	290	CW
75	Westgh.	220/440/2200	580	CW
50	G.E.	2200	900	IM
60/12.5	G.E.	2200	865/435	IM
37	Otis	220/440	1140	Int.
5–30	Westgh.	220/440	865	CW
30	F. M.	220/440	1150	Ball Brg.

SLIP RING—3 ph. 25 cy.

HP	Make	Volts	RPM	Type
100	G.E.	220/440	500	MI 108

Syn. Condenser 900 RPM
5000 KVA West. 2300/4000/3/60 with 28 KW 125 v. Type SK dir. con. exciter. (Late Type)

SQUIRREL CAGE—3 ph. 60 cy.

HP	Make	Volts	RPM	Type
1000	G.E.	2200	514	KT
150	Westgh.	220/440	580	CCL
100	G.E.	220/440	1150	I K
2–50	Triumph	220/440	685	B
40	Westgh.	220/440	575	CS
40	Elliott	220/440	1150	
30	Al. Ch.	220/440	1150	AN
30	Al. Ch.	220/440	860	AN
25/7½	Cr. Wh.	2200	1150/585	119 AQ
25	Elec. Mchry	220/440	495	
15	Westgh.	220/440	965	CS Int.

TRANSFORMERS

KVA	Make	Pri. V.	Sec. V
3–500	G.E.	25000	2200
3–300	G.E.	25000/11000	110
3–50	G.E.	23000	2200
2–25	G.E.	2200	244/488
1–37½	West.	2300	460/230
1–25	Al. Ch.	2200	440/220
10–10	Westgh.	2200	122/244
35–7½	G.E.	2200/1100	122/244

DC MOTORS

HP	Make	Volts	RPM	Type
230	G.E. (Ser.)	500	475	MD 109.5
175	Westgh.	250	320	S
175	G.E. (Ser.)	250	475	MDS 109½
140	Westgh. (Ser.)	500	515	MC 90
130	G.E. (Ser.)	230	550	CO1812A
100	G.E. (Ser.)	230	480	MD 108
100	G.E. (Ser.)	500	650	CO 1812
100	G.E.	115	575	DLC
70	G.E.	230	800	CL
60	G.E.	230	600	CO 2507
40	Westgh.	230	550/1650	SK 150
30	Cr. Wh.	230	1750	CCM

SYNCHRONOUS MOTORS—3 ph. 60 cy.

HP	Make	Volts	RPM	Type
200	Westgh.	2200	900	.8 P.F.
150	G. E.	2200	900	ATI-.8 P.F.

AC & DC GENERATORS

200 KVA. 8 P.F. 160 KW 2400/3/60 720 RPM G.E.
150 KW 250 v. 450 RPM Westgh. Type S
100 KW 250 v. G.E. 600 RPM
2—100 KW 250 v. Westgh. SK 900 RPM
75 KW 125 v. 700 RPM G.E. Type DLC
60 KW 275 v. G.E. 1150 RPM Type CL

SYN. MOTOR GENERATOR SETS

150 KW G.E. 230 v. 900 RPM cpd. interpole dir. con. 225 HP G.E. ATI 2300/4000 v. 3 ph. 60 cy. with swbds. Rebuilt—Ready for shipment.
100 KW Westgh. SK 250 v. 900 RPM dir. con. 150 HP G.E. 2200/3/60 ATI with swbds.
65 KW G.E. Type CL 275 v. 1150 RPM cp. wd. dir. con. to 100 HP G.E. Type I Form K, 2200/440/3/60 1150 RPM with panel and starting equipment.
25 KW G.E. Type RC 125 v. cp. wd. 1800 RPM interpole dir. con. 40 HP G.E. Type KT 220/440 v. 3 ph. 60 cy. 1800 RPM with starting equipment.

ARC WELDER M-G Sets

600 amp. Lincoln 220/440 3 ph. 60 cy.
3—300 amp. Lincoln 220/440 v. 3 ph. 60 cy.
5—400 amp. Lincoln 220/440 v. 3 ph. 60 cy.

ROLLING MILL DRIVE

500 HP G.E. MT 412 slip ring 2200/3/60 435 RPM 3 bearing with Morse Chain drive, 14" wide, 84" centers motor pinion 25 Teeth split sprocket 107 Teeth, 14" bore with oil tight steel enclosure oil pump.

AIR COMPRESSORS

1—550 cu. ft. 110# 2 stage 16 & 10 x 14 belted to 100 HP AC Motor
2—565 cu. ft. 55# Sullivan 14 x 10 Belted.
1—492 cu. ft. 100# Chica. Pn. plate valve oil engine driven straight line unit
2—355 cu. ft. 100# Ing. Rd. ER 1, 100#, 12 x 10 with idlers, plate valve, and equipped with AC or DC Motor.
1—164 cu. ft. 100# Chg. Pn. Type GSS Steam unit

Send us your inquiries we have many other items too numerous to list.

MOORHEAD-REITMEYER CO. INC.
PITTSBURGH, 19, PA.

Dealing in Rebuilt electrical machinery-Exclusively—for a Quarter of a Century.

DIESELS

3—460 H.P.
McINTOSH & SEYMOUR
SOLID INJECTION
900 KW, A.C.
1935

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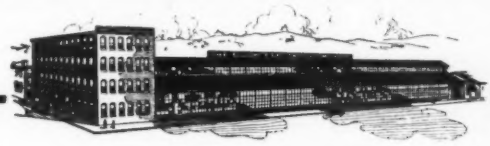

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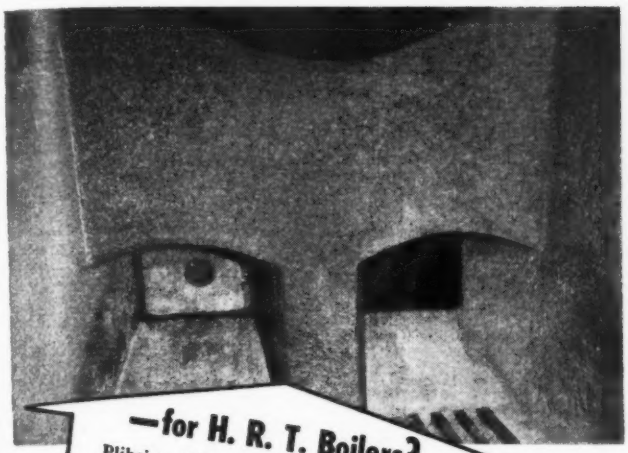

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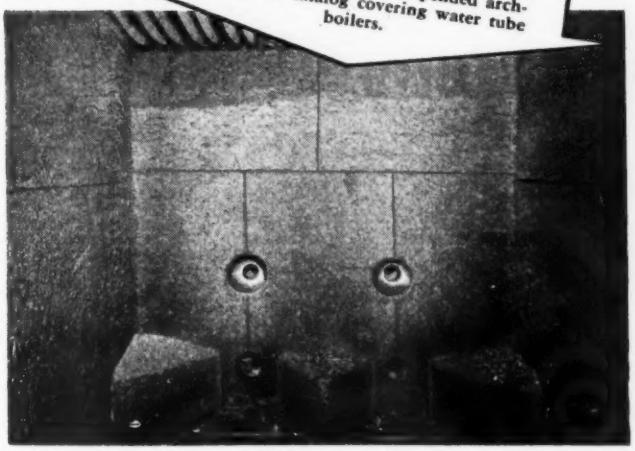

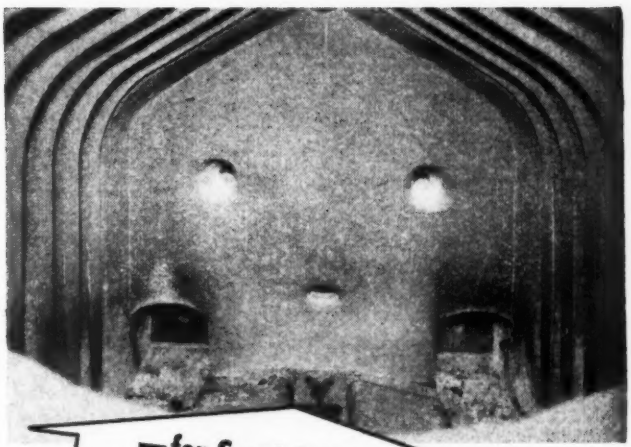

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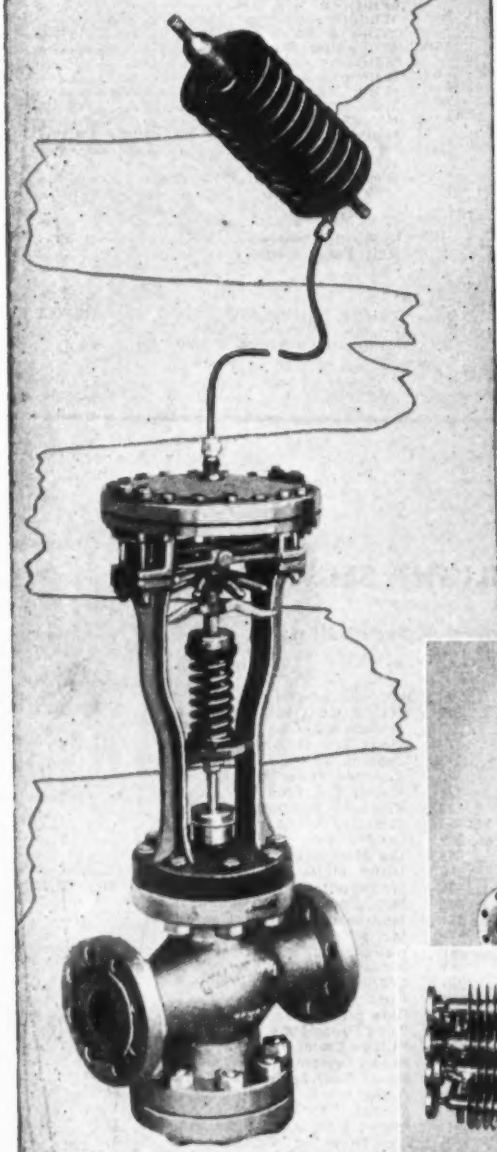
when you need dramatic speed in your power plant?

From FULL LOAD to ABSOLUTE SHUTDOWN *in less than one minute*

Handled without a murmur by Swartwout FEED WATER REGULATORS



THAT'S unusual service—but you may have a similar feed water problem some time. The equipment featured here is scheduled for a type of service that demands *speed in operation*—where boilers are required to operate anywhere from 0 to 100% of capacity. Under normal conditions, *without any warning,* they are required to go from normal load to absolute shutdown—and we mean SHUTDOWN—and be held under banked condition for sustained periods or for extremely short periods. Swartwout "S-C" Feed Water Regulators have a sound record of trouble-free performance on boilers of all pressures. *Write for Bulletin S-20-D.*

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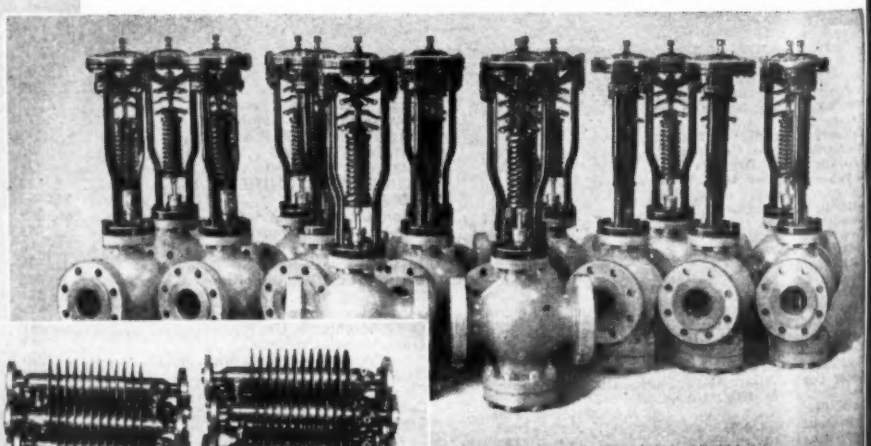
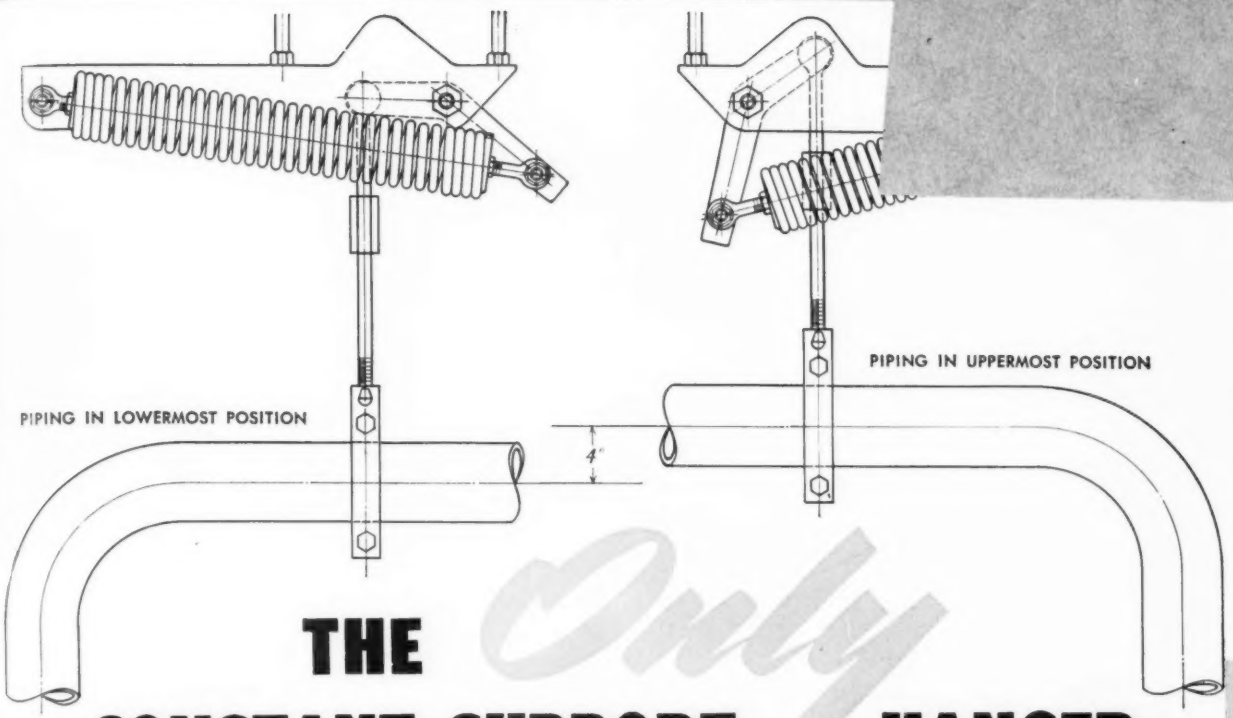


PHOTOGRAPHS *represent one of the monthly shipments of Swartwout Feed Water Regulators destined for important service.*

Swartwout POWER PLANT EQUIPMENT



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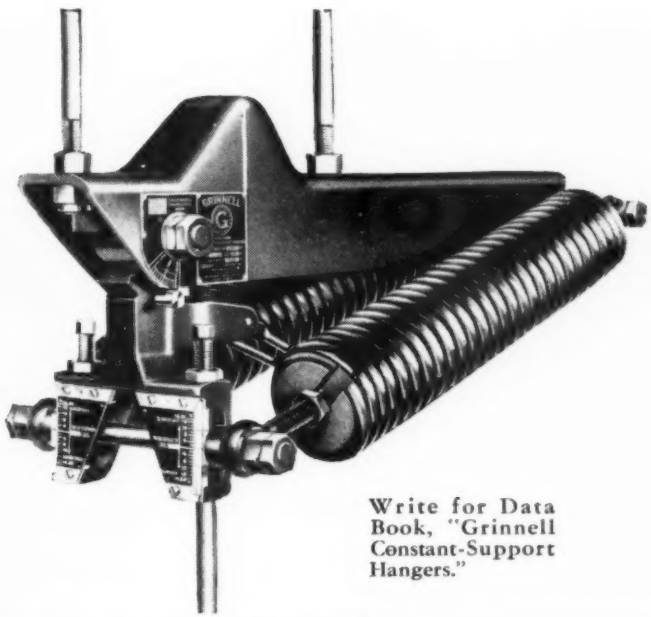

Write for Data Book, "Grinnell Constant-Support Hangers."

EXCLUSIVE FEATURES OF GRINNELL CONSTANT-SUPPORT HANGERS

Constant-support of piping in all "hot" and "cold" positions.

Full safety factor of the supported system is always maintained.

Mass produced from standard precision parts.

Individually calibrated for each specific installation.

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GRINNELL

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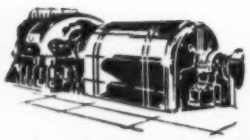
EXTRA RESISTANCE TO OXIDATION, RUST

...added to a base stock that is in itself an excellent, high-grade, long-lasting Turbine Oil...

NEW GARGOYLE D.T.E. OIL



THIS great new turbine oil —Gargoyle D. T. E. Oil 797—combines all three of the factors needed to make the ideal turbine oil—a base stock that is in itself an excellent turbine oil, maximum resistance to oxidation and maximum anti-rust qualities.

As a result, Gargoyle D. T. E. Oil 797 has already proved its superiority. In severe oxidation tests, it stood up a great deal longer than other leading turbine oils.

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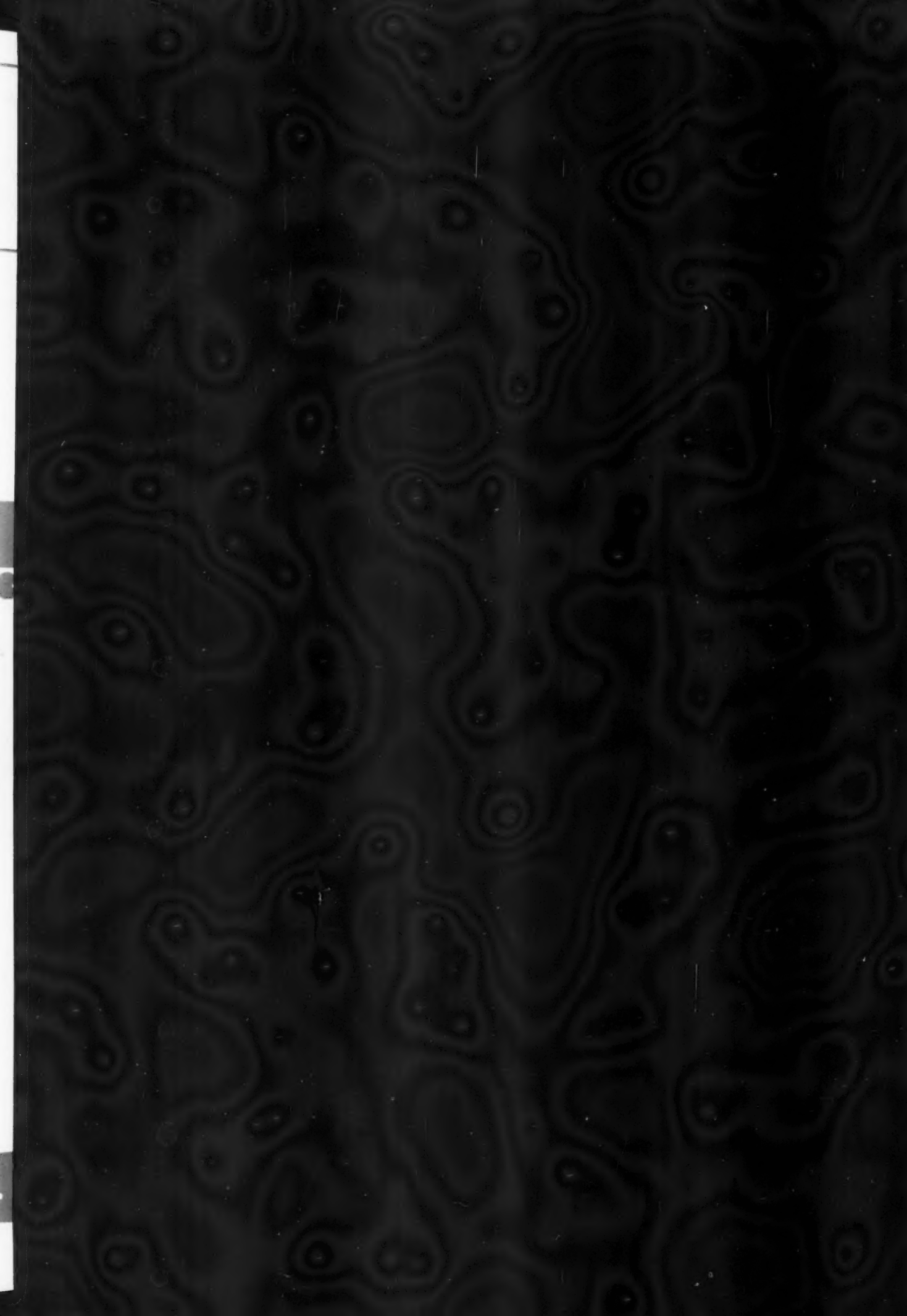
THE NEW GARGOYLE D. T. E. OIL 797 HAS ALL OF THESE NECESSARY CHARACTERISTICS

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